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GROUND-WOOD PULP.

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OBJECT OF THE BULLETIN.

This bulletin presents the results of tests on (a) the grinding of steamed or cooked spruce for mechanical pulp and (b) the results of tests on a number of American woods to determine their suitability as substitutes for spruce in the manufacture of ground-wood pulp.¹ If the price of news-print paper is to be kept at a reasonable figure, more efficient methods of converting spruce into pulp must be developed or else a cheaper wood substituted for the former. The results of experiments meant to develop greater efficiency in the grinding of uncooked spruce have already been presented in Forest Service Bulletin 127, "The Grinding of Spruce for Mechanical Pulp." That bulletin also discusses the influence of the many

¹ Acknowledgment is made to Mr. C. P. Winslow, Mr. Henry E. Surface, and Mr. S. D. Wells, engineers in forest products, and to Mr. S. E. Lunak, assistant chemist in forest products, Forest Service, for aid in the preparation of this report. Acknowledgment is also due Messrs. G. F. Steele, W. G. McNaughton, and L. M. Alexander, of the Nekoosa-Edwards Paper Co., and Mr. D. C. Everest, of the Marathon Paper Mills Co., for assistance rendered during the tests; also to Mr. C. W. Knapp, of the St. Louis Republic, and to Messrs. P. W. Schaeffer and E. D. De Witt, of the New York Herald, for providing the presses upon which the experimental papers were tried out. The maps in this bulletin showing the range of the various tree species were prepared in the Forest Service by Mr. William H. Lamb, assisted by Miss Georgia Wharton.

NOTE.—This bulletin contains valuable information as to the use of various species of wood in the manufacture of paper and is of interest to manufacturers and users of paper.

variable conditions in the manufacture of mechanical pulp, such as surface of stone, pressure with which the wood is forced upon it, peripheral speed, temperature of grinding, etc. Since the conclusions reached in regard to these are applicable to the production of pulp from coniferous woods in general, it is advisable to have a copy of Bulletin 127 at hand when reading the present one.¹

All the tests described in this bulletin were carried on at the Forest Service ground-wood laboratory at Wausau, Wis., a branch of the Forest Products Laboratory, Madison, Wis., in cooperation with the American Paper and Pulp Association, which furnished all the pulp-making equipment for the laboratory, and with an advisory committee consisting of Messrs. G. F. Steele, chairman, and W. G. McNaughton, secretary, Nekoosa-Edwards Paper Co.; D. C. Everest, Marathon Paper Mills Co.; W. L. Edmonds, Wausau Paper Mills Co.; A. M. Pride, Tomahawk Paper Co.; and William Eibel, Rhineland Paper Co.

PRESENT STATUS OF THE GROUND-WOOD INDUSTRY.

Thirty-five to forty-five years ago news paper was made almost entirely of rags. Upon the introduction of the sulphite process of wood-pulp manufacture varying amounts of that product were added to the rag pulp, and later ground wood was made a part of the mixture, but only in small quantities. Ground wood was for many years nothing more nor less than a filler and not expected to add any strength to the sheet produced. There is shown in figure 1 the average contract price (f. o. b. mill) of news-print paper from 1874 to 1912. The effect of the introduction of the cheaper processes is evident.

In 1870 there were only 8 establishments reported which made ground wood, and the product manufactured during that year was valued at \$172,000. Ten years later, in 1880, 50 establishments produced \$2,257,000 worth of ground wood. In 1890, 82 establishments reported products valued at \$4,628,000. In 1900 there were 91 plants reported, which produced 280,520 tons of ground wood for sale, and 77 mills which produced 306,520 tons of pulp for their own use, a total of 168 mills, producing 586,000 tons, valued at approximately \$9,300,000. In 1909 there were produced a total of 1,179,266 tons of mechanical pulp. Of this amount 310,747 tons were manufactured for sale or consumption in mills other than where produced, the value being \$5,649,466. The remainder, 868,519 tons, assumed to have the same value of that made for sale, was worth approximately \$15,780,000, or a total value of product of \$21,430,000.

¹ Copies of Forest Service Bulletin 127 may be procured from the Superintendent of Documents, Washington, D. C., for 15 cents each.

In 1911, 1,229,719 tons of mechanical pulp were produced, an increase of approximately 50,000 tons.

While the industry has developed very rapidly in the United States, the rate of development has not kept pace with the rate of consumption of the product. This is evident from a consideration of the imports and exports of both mechanical and chemical pulp over a period of years, as shown in figures 2 and 3. Figure 2 shows the imports of mechanical pulp, both free and dutiable, by months for a period of years, while figure 3 (curve *B*) shows the imports of mechanical pulp by years. The first of these curves is particularly



FIG. 1.—Average contract prices for news-print paper 1878-1912.

interesting, because it shows the seasonal fluctuation of imports. Figure 3 (curve *A*) shows the imports and exports of wood pulp, both mechanical and chemical. The increase in the amount of pulp imported is very marked, while the exports are comparatively small. It is evident from these curves that considerably more pulp will have to be manufactured at home before there can be any material expansion into the export trade.

Spruce furnishes by far the greater part of the wood at present used for mechanical pulp. Of the 1,314,141 cords consumed in the United States by the mechanical process in 1911, spruce supplied 1,121,703 cords, or 85 per cent, 822,743 cords of which were native

wood and 298,743 imported. Of the 4,328,052 cords of wood used in the United States in 1911 for pulp of all kinds, spruce furnished 2,505,730 cords, or 57 per cent.

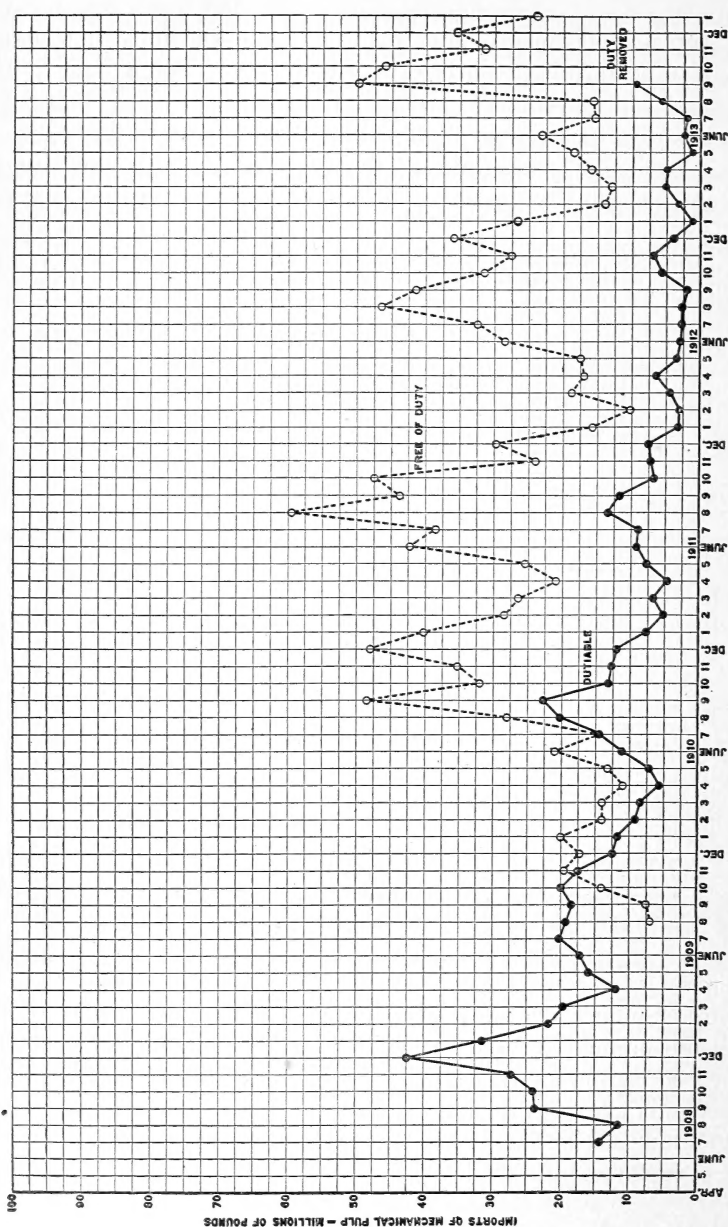


Fig. 2.—Imports of mechanical pulp, July, 1908, to January, 1914, inclusive.

The annual consumption of spruce in this country for all purposes is something like 2,575,000,000 board feet. The available stand east of the Rocky Mountains was estimated in 1907 to be 35,000,000,000

feet, with an annual increment due to growth of 770,000,000 feet. While it is probable that the maximum annual consumption of spruce for lumber has been reached, and that that for pulp wood will scarcely go much higher, it is nevertheless clear that with the maintenance of anything like the present annual consumption the spruce forests of this country are threatened with exhaustion. Nor is it likely that the American consumer of spruce wood will be able to draw to whatever extent he wishes upon the Canadian supply. In 1900 the Province of Ontario prohibited the exportation of unmanufactured wood cut on Crown lands within the Province, and later the Provinces

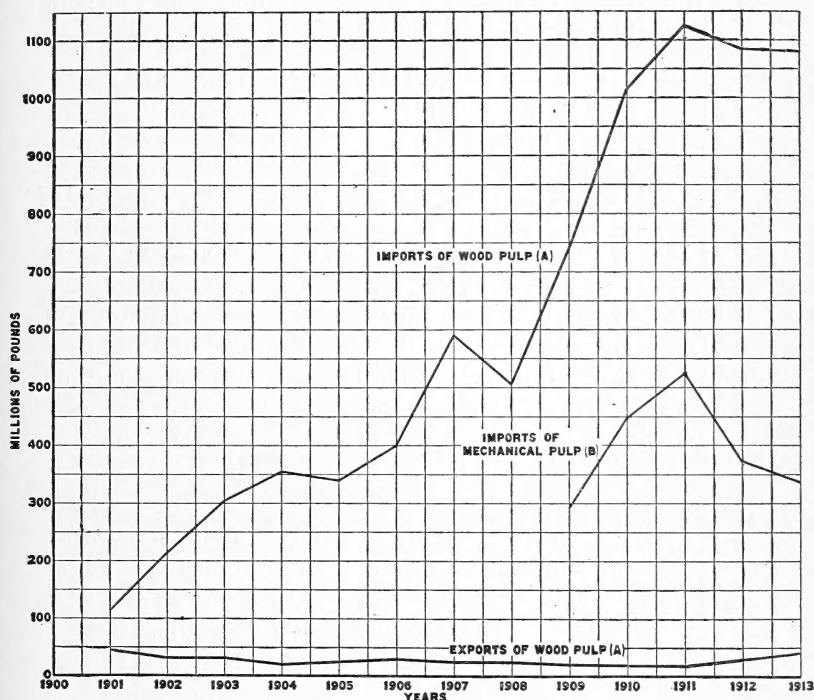


FIG. 3.—Imports and exports of wood pulp, 1901-1913, inclusive.

of Quebec (1909) and New Brunswick (1911) passed similar legislation. Further restrictive measures regarding the exportation of unmanufactured wood will undoubtedly be taken by Canada if the need arises.

The rise in the price of spruce over the 10-year period from 1900 to 1909, inclusive, reflects a steady increase in the consumption of mechanical pulp and a decrease in the available supply of the wood. In 1900 the average cost of spruce used for pulp-making purposes in the United States was \$4.28 per cord for domestic and \$6.50 per cord for imported material. In 1909 the average price for domestic spruce

had risen to \$8.32 per cord, and for imported to \$11.34 per cord. During the same 10-year period the average cost of manufacturing ground-wood pulp increased from \$10.84 per ton to \$16.58, by far the greater part of this increase being due to the greater cost of the wood used. Thus the manufacturer of mechanical pulp is faced with a steady increase in the cost of his raw material, and one which promises to continue if he must rely almost wholly upon a single wood. The great bulk of mechanical pulp produced is used in the manufacture of news-print paper, and the problem which presents itself is whether woods other than spruce can be used for the purpose. It was to answer this question, at least in part, that the experiments described in this bulletin were undertaken.

PRESENT METHODS OF MANUFACTURE.

The present method of manufacturing ground-wood pulp has been in use for a long time. Since 1867, when the mechanical process was first introduced into this country, principles and methods have changed but slightly. The size and capacity of the grinders have been increased and the raw material changed from poplar to spruce, but otherwise the industry is following its first lines. As in any other industry, however, details of manufacture differ in different mills. Of two mills producing news-print paper, for example, one uses 135 horsepower to the grinder, the other 625. One employs a grinder cylinder pressure of 17.5 pounds per square inch; the other, with a cylinder of the same size, a pressure of 72 pounds. One runs at a peripheral speed of 2,660 feet per minute, the other at a speed of 3,540 feet. Such details of operation may differ among mills producing the same kind of paper even more widely than those just cited. Reports of power consumption show a range of from 31 to 135 horsepower per ton in 24 hours. The first value is undoubtedly wrong, since it has been demonstrated experimentally that such a low power consumption is impossible with the present grinding equipment.

Upon its receipt at the mill the wood is either stored for a considerable time in the yard or else is ponded. Before storage the wood is sometimes cut into 2-foot lengths, or in other cases is rossed.

The grinders ordinarily take a pulp-stone approximately 54 inches in diameter by 27 inches face. Some stones recently installed are as large as 60 inches in diameter and 48 inches face. Up to a few years ago natural quarried stones were the only kind used in the grinding process, but many mills are now experimenting with artificial stones. The grinding is usually carried on under conditions of high temperature brought about by admitting only small quantities of water to the pit of the grinder. In the cold-grinding process, which is sometimes used in the United States and very largely adhered to in Europe, an excess of water prevents any heating.

Upon leaving the grinder a large supply of water is added to the pulp, and the mixture is then screened. If it is to be shipped over a long distance, the pulp is run into laps by means either of wet machines or of hydraulic presses. Occasionally the pulp is dried on steam driers and run into rolls. When pulp is used where it is produced, except for the need of storing to provide a supply in times of low water, it is thickened by means of feltless wet machines or deckers and immediately manufactured into paper.

In the last few years a magazine pulp grinder has come into use, equipped with two pockets which are filled automatically from the magazine. The machine, however, has not been operated in this country to an extent which would enable a judgment to be formed regarding its efficiency and economy.

Part I.—THE GRINDING OF COOKED AND UNCOOKED SPRUCE.

EQUIPMENT USED IN THE EXPERIMENTS.¹

APPARATUS FOR COOKING.

Cooking treatments prior to grinding were carried on in a cylindrical closed steamer 3 feet in diameter by 8 feet high, designed for 75 pounds' working pressure. The "steamer" was fitted with steam, water, and vacuum connections and the necessary gauges and thermometers for determinations of pressure and temperature. An open steamer 6 feet wide, 8 feet long, and 3 feet deep was also available for cooking treatment at atmospheric pressure.

ELECTRICAL EQUIPMENT.

In order to satisfactorily vary the conditions of grinding, secure adequate data on power consumption, and maintain the speed constant, it was necessary to install a rather complex system of electrical drive and control for the grinder. The method of speed regulation was known as the Ward Leonard system, and by its means a very flexible arrangement was secured.

The installation consisted of a motor generator set of 460-kilo-volt-amperes full-load capacity and a direct-current, variable-speed motor having a full-load capacity of 500 horsepower at 300 revolutions per minute. With the overload capacity it was possible to secure fully 75 per cent more power than the rating from each of the machines.

Three-phase 60-cycle electric power was applied to the synchronous motor of the motor generator set at 2,300 volts. The generator of the motor generator set was separately excited and by means of a rheostat

¹ A more detailed description of the equipment of the Forest Service laboratory at Wausau, Wis., is given in an unnumbered publication of the Forest Service, "Experiments with Jack Pine and Hemlock for Mechanical Pulp."

in the field circuit direct current could be generated at any desired voltage from 100 to 700 volts. The direct-current motor connected to the grinder was also separately excited and the speed of rotation controlled by regulating the voltage applied to the armature, the voltage control being brought about by variation of the field current of the direct-current generator. The speed of the grinder motor could be varied from 100 revolutions per minute to 300 revolutions per minute, the capacity with overload at the same time varying from approximately 340 horsepower to 750 horsepower.

The efficiency of the direct-current motor could be determined very readily by means of curves showing the stray power and heat losses at different speeds and current loads and knowledge of the power supplied to the motor. The latter data were obtained by means of accurately calibrated indicating and recording electrical instruments.

The various pieces of apparatus used in the manufacture of the pulp were driven by individual direct-connected motors. The apparatus for wood preparation, 40-inch swing saw, and "Green Bay" barker, together with the wet machine vacuum pump, were driven from a single-belted motor. Some of the individual motors were of the variable-speed type, and as a result the pieces of apparatus to which they were connected could be driven at the most effective speeds.

PULP MACHINERY AND AUXILIARY EQUIPMENT.

All of the pieces of machinery installed in the Wausau laboratory were of commercial size and design and were loaned either by manufacturers or others interested in the work being carried on.

The grinder was built by the Friction Pulley and Machine Works. It took a stone 54 inches in diameter by 27-inch face and had three 14-inch cylinders. Each cylinder was provided with a pressure gauge and the water was supplied by two triplex pumps. The pressure at which the water was pumped was regulated by relief valves; pressures as high as 120 pounds per square inch could be obtained.

A recording thermometer gave a record of the temperature in the grinder pit. From the grinder pit the pulp was passed through a mechanically agitated sliver screen, then pumped to a storage tank by means of a 5-inch centrifugal pump, and from there pumped to a centrifugal screen. A variable-speed motor direct connected to the screen made it possible to obtain speeds of rotation from 400 to 600 revolutions per minute. Throughout the tests, however, the speed was maintained at 500 revolutions per minute. The plate in the centrifugal screen was perforated with holes 0.065 inch in diameter.

The tailings from the centrifugal screen were rescreened through a 12-plate Harmon diaphragm screen, the plates used being the Union Screen Plate Co.'s type B, cut with 0.012-inch slots.

The screened pulps from the centrifugal and the flat screen were united and run out on an Improved Paper Machinery Co.'s 3-roll hydraulic wet machine. The white water from the wet machine was pumped back to the sliver screen of the grinder by means of a 4-inch centrifugal pump. White water from the felts was run to the sewer, as was also the white water from the felt suction.

PAPER-MAKING EQUIPMENT.

Portions of the pulps secured from experimental runs were sent to the Forest Products Laboratory at Madison to be run into paper. The apparatus available for the purpose when the earliest tests were made consisted of a pulp shredder, 12-pound Emerson beater, 2-plate flat screen slotted with 0.012-inch slots, and a 12-inch Fourdrinier paper machine. Later a Noble and Wood's jordan engine was added to the equipment. This was used only, however, in the preparation for the paper machine of pulps made from miscellaneous woods. The stock which was run on the machine in carrying on series tests to determine the effect of variable grinding conditions on the strength of pulp was not jordaned.

METHODS EMPLOYED IN EXPERIMENTAL TESTS.

PREPARATION OF WOOD.

All of the wood received at the laboratory was stored on skids in the yard and in most cases allowed to season before being used. It was received in several different forms; some cut from very large trees was split before shipping; some was rossed in the woods; but the greater part was in the form of round rough logs varying from 4 to 14 inches in diameter. The wood for test was sawed as required into 2-foot sections and barked, samples being taken for the determination of moisture and dry weight per cubic foot. The amount desired for the test was weighed and the diameter of each piece was measured. Tests were conducted as soon as possible after the wood was prepared and weighed.

In some cases it was necessary to remove knots before grinding, especially when the knots were likely to cause dirt in the pulp. This procedure was more often required for jack pine and aspen than for other woods.

In case the wood was to be treated it was piled in the steamer after having been carefully weighed. Depending on the conditions of the cook, the pressure was maintained constant at the desired value for different lengths of time. Cooks were made at steam pressures of from 5 to 75 pounds per square inch and for different lengths of time, from 1 to 12 hours. In some cases the wood was steamed and the condensation was drawn off as it formed; in others, the wood was immersed in water and boiled at different steam pressures, the

condensation being blown off as soon as the temperature fell below that corresponding to the steam pressure in use. In some cases, after cooking the required length of time, the charge was allowed to stand until it had absorbed a large amount of water. After unloading, the wood was weighed and then ground as soon as possible. In several instances samples were taken after cooking and the bone-dry weight and the moisture were determined.

GRINDING.

Before starting the test the desired surface was placed on the stone by means of a mechanically controlled burr or bush roll. The stone was then washed until free from loose sand and an impression of the stone was taken by means of carbon and coated paper. (See Forest Service Bulletin 127.) The grinder pockets were filled, the pressure adjusted to the correct value, the recording instruments were placed in operation, and the test was then started.

The speed and pressure were maintained as constant as possible throughout each test. Pocket binding was eliminated by the constant observation of power applied to the grinder, a falling off in power consumption with pressure on indicating binding. When a piston was raised, instead of allowing the speed to increase, it was held constant by regulation of the voltage on the motor armature.

In series tests in which the surface of the stone was not altered, but the speed, pressure, or temperature were, the data secured may be more or less open to criticism, since the surface undoubtedly changed slightly from one test to another. However, this change was very slight.¹ Likewise, in short tests it was impossible to heat up the stone thoroughly and here also a very slight error was introduced.¹

During the tests readings were taken of power, speed, pressure, temperature, and the like, the intervals of reading being 15 minutes in most cases, although 5-minute intervals were sometimes employed.

LOSSES IN CONVERSION.

While it is highly desirable that the losses occurring in the barking of different woods be determined, it was impossible to investigate this point satisfactorily. Only small amounts of wood were used, in some cases not more than 8 cords, and determinations on such small amounts would not yield reliable results.

The amount of wood used during any test and the amount of wet pulp manufactured was accurately determined by weighing. Moisture samples were taken of both the pulp and the screenings and the bone-dry weight of each determined. In some cases the amount of wood fiber in the white water was secured by measuring the amount

¹ This point is discussed in more detail in Forest Service Bulletin 127, "The Grinding of Spruce for Mechanical Pulp."

of white water used and determining the wood fiber in a sample of it. This proved rather unsatisfactory, and was discontinued on account of the difficulty in removing the wood fiber from the white water sample.

The yield of pulp has been calculated to a basis of 100 cubic feet of solid rossed wood, this factor being thought more satisfactory and accurate than a measured cord, and representing approximately the solid content of a piled cord of 2-foot rossed wood containing 128 cubic feet.

TESTS ON THE PAPER.

The sample of pulp to be run into paper was first shredded and the moisture determined. The required amount was then weighed out and mixed and beaten with a weighed amount of bleached spruce slow-cook sulphite. In some runs, particularly those made on some of the pulps made from cooked woods, the sulphite was dispensed with. The mixture, usually 20 per cent sulphite to 80 per cent ground wood, was beaten until the fibers were separated, generally about 1 hour. The stock was then run out on the paper machine and an uncalendered sample was taken for strength and color tests.

No size, color, or loading was added to any of the sheets, the desire being to present the pulps made from different woods and under different conditions in as nearly comparable conditions as possible.

The uncalendered samples of paper were tested for tensile strength, lengthwise and crosswise, by means of a Schopper breaking length tester, and for bursting strength by means of a Mullen tester. The color tests were made with an Ives tintphotometer and measurements were made of the thickness of the sheet and weight per ream.

EFFECT OF PRELIMINARY TREATMENT OF SPRUCE.

Spruce has been used for many years as a raw material for ground-wood pulp, but the effect of the production of pulp from it under varying conditions has never been given very careful study. Depending on the quality of the product desired, different conditions of grinding must be selected, and in some cases the wood must even be given a cooking treatment prior to grinding. In the manufacture of container board, where great strength is desired and the color is of lesser consequence, strength is often increased by the addition of sulphite or sulphate pulp, screenings, or old paper stock. In the manufacture of news print paper, strength is desired too, but not nearly so much strength, the color, yield, and finishing characteristics here being the prime consideration. The work which has been done on spruce has been carried on with the idea of attempting to increase the efficiency of grinding both from the standpoint of reducing the power consumption and increasing the yield from a cord of the raw material in either the cooking or ordinary ground-wood process, and

to ascertain the influence on the quality and quantity of pulp produced by the variation of the grinding variables, such as surface of the stone, pressure on the cylinders, speed, temperature, etc.

The cooking of wood prior to grinding is attended with a number of changes in the physical characteristics of the wood which greatly influence the quality of the pulp manufactured from it. The cooking condition must be chosen according to the use to which the pulp is to be put. For the manufacture of news-print paper from pitchy woods it is essential that the treatment be a very mild one, and that the duration of boiling or steaming and the temperature at which it is carried on be such as to allow of the fiber being as light in color as possible. Either the pressure, or corresponding temperature, must be low and the cook of long duration, or the pressure higher and the

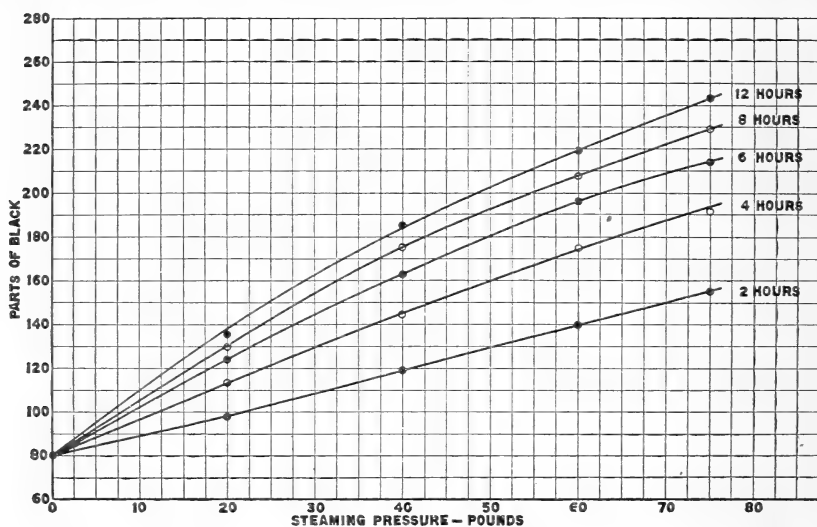


FIG. 4.—Effect of steaming pressure on color of pulp (average values of several runs on spruce).

cook of much shorter duration. It is generally claimed that cooking the wood under pressure while immersed in water will yield a lighter pulp than steaming at the same pressure and for the same length of time, but this result has not been noted.

Boiling wood has certain disadvantages which are not found when the steaming process is used. There is a considerable loss of heat, and it is necessary to draw off condensed liquors to maintain the temperature at any desired value. This makes it necessary to pay greater attention to the process. If the temperature and duration of the cook are the same, the steamed or boiled wood should be practically the same in color and other physical characteristics. One decided advantage of steaming is the possibility of draining off the condensed liquors in a concentrated form. This is of great benefit when by-products are to be recovered.

In all of the experiments conducted in cooking wood prior to grinding, the temperature corresponded to the temperature of boiling at the steam pressure under which the cook was being made. Attempts were made to secure by-products, but the amounts of wood used were so small that this could not be done satisfactorily.

INFLUENCE OF PRESSURE, TEMPERATURE, AND TIME OF COOKING.

When the length of time of the cook is kept constant and the cooking pressure or temperature is varied, it is found that the color of the pulp made darkens greatly when these factors are raised, all other conditions being the same. This is demonstrated by reference to the

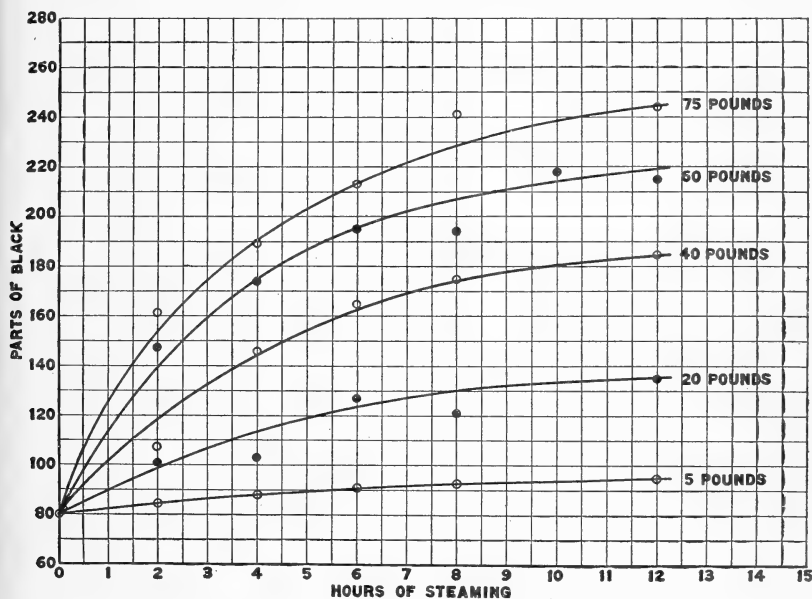


FIG. 5.—Effect of duration of steaming on color of pulp. (Average values of several runs on spruce.)

curves in figures 4 and 5, where the amount of black in the color as determined by a tintphotometer is plotted against the cooking pressure and temperature. At some steam pressure the wood will char and the resultant pulp will be black; under this condition a maximum of 300 parts black would be secured. It is probable that this steam pressure would not be very high, since the values of parts of black increase rapidly after 60 pounds pressure is reached.

The strength of the pulp increases with the length of the steaming period (fig. 6) and seems to reach a maximum in about 8 hours for both pressures. In figure 7 is shown the variation of the yield of pulp per 100 cubic feet of solid rossed wood, with the pressure of steaming and the duration of the cook. The marked effect of the duration of the cook, especially at high pressure, is evident. The yield decreases

rapidly with increased pressure due to the dissolving action of the water and the transformation of portions of the wood into water soluble material which is washed out in the grinding process.

Variation of the period of cook also has a marked influence upon the horsepower consumption per ton of pulp. When wood is ground under the same conditions of grinder pressure, speed, temperature, etc., it is found that after a period of four to six hours of cooking the maximum value of power consumption is obtained. For a greater

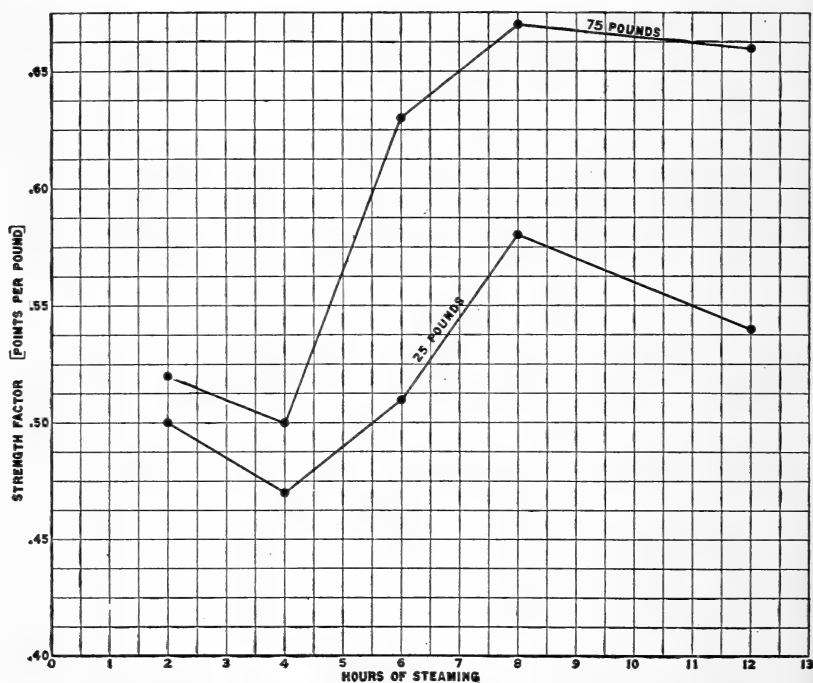


FIG. 6.—Effect of duration of steaming upon the strength of the pulp. (Spruce runs 199-209, inclusive.)

or lesser length of time of cooking the horsepower consumption per ton decreases (fig. 8).

OTHER FACTORS.

The variation of the yield of pulp from 100 cubic feet of solid wood with the duration of cook and temperature of cooking has been pointed out. It would seem that most of the loss would occur in the cooking process itself, but determinations of the amount of bone-dry wood charged to the cooker and the amount of bone-dry material taken from it after steaming shows that the loss in cooking as volatile materials and water-soluble substances which leach out when the wood is in the 2-foot lengths is remarkably low, being from 5 to 8 per cent. It appears that the great loss which takes place in the produc-

tion of steamed wood pulp occurs in the grinding process, either due to the dissolving of material which has been converted to a soluble state or the grinding of the softer portion of the wood—the springwood—to flour and the subsequent loss of it in the white water. There is a characteristic odor of burned sugar during the steaming of wood, and possibly some of the wood fiber is converted into sugar.

The condensed liquor from the steamer has a very corrosive action on the iron and it is possible that in order to satisfactorily protect

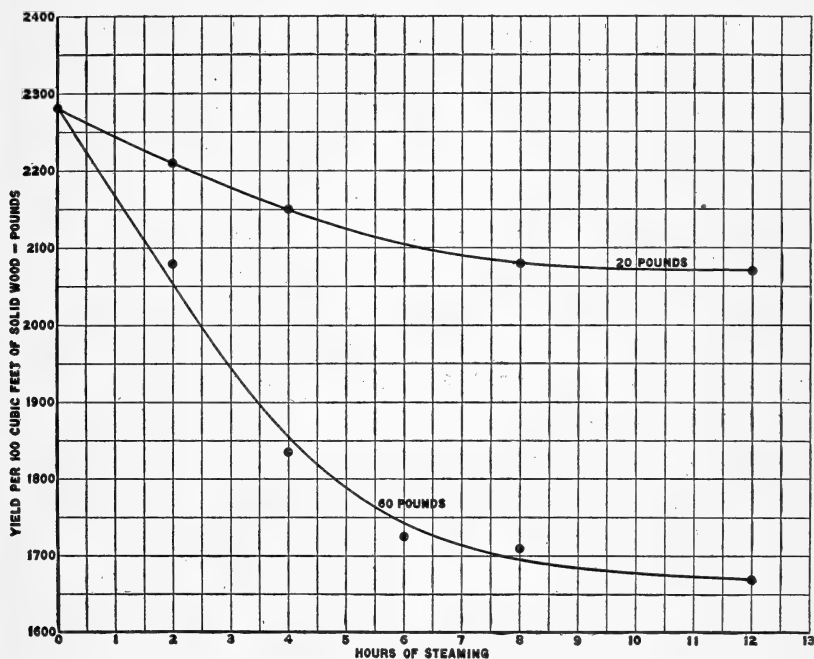


Fig. 7.—Effect of duration and pressure of steaming on the yield of pulp. (Spruce runs 103 to 107 and 114 to 119, inclusive.)

the metal it might be desirable to add small quantities of sodium carbonate to the water when the boiling process is used. This, of course, would not apply when the wood is steamed.

The liquors which condense during the steaming of the woods may have considerable commercial value, particularly when resinous woods are used. The equipment employed in the Wausau laboratory was not of sufficient capacity to make it possible to study this problem carefully, but an indication of the nature of the condensed liquor can be obtained from the following analyses of material secured from a mill steaming wood commercially, in which case approximately 5 cords of wood were used for each charge. Unfortunately no means were available for measuring the total condensed

liquor, and for that reason the amount of the materials can not be expressed in quantity per cord.

It will be noted that two samples were analyzed, one of which was a residue from evaporation of a condensed liquor and the other a sample of the liquor from another cook. The woods steamed were a

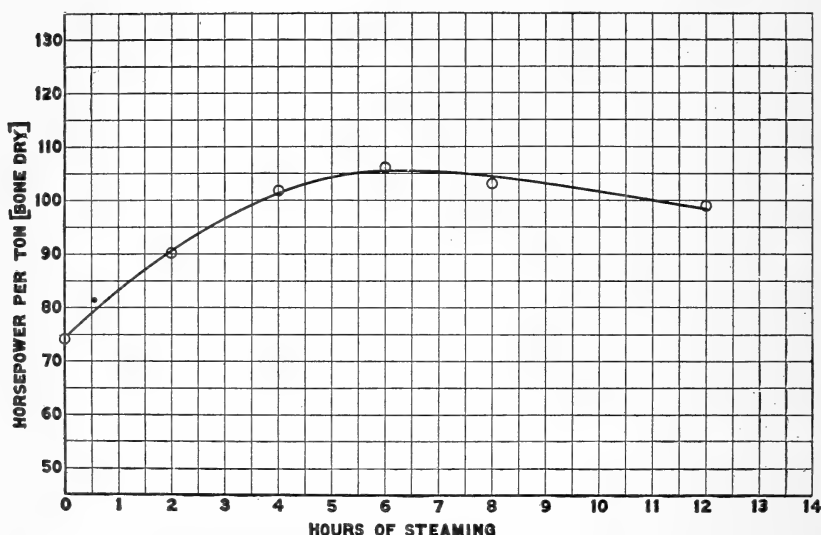


FIG. 8.—Effect of duration of steaming on power consumption per ton of pulp. (Spruce runs 114-119, inclusive.)

mixture of jack pine and tamarack in the ratio of 67 per cent of the former to 33 per cent of the latter.

| | Residue from evapo- ration of liquor. | Sample of liquor. | | Residue from evapo- ration of liquor. | Sample of liquor. |
|----------------------|--|----------------------|--------------------------|--|----------------------|
| | <i>Per cent.</i> | <i>Per cent.</i> | | <i>Per cent.</i> | <i>Per cent.</i> |
| Total solids..... | | 2.05 | Ash..... | 9.85 | 0.049 |
| Soluble solids..... | 70.10 | 1.95 | Acetic acid (total)..... | 5.71 | .162 |
| Reducing sugars..... | 15.89 | .83 | Formic acid (total)..... | 1.41 | .042 |
| Tannins..... | 13.60 | .092 | Moisture..... | 4.31 | 97.95 |

The total and soluble solids and tannin were determined according to the methods outlined by the American Leather Chemists' Association.

The boiling or steaming of woods results in the formation of a natural size from the wood substance or some of its constituents. This sizing action is particularly noticeable in the production of pulps from the hardwoods—birch and aspen—which are not pitchy. All paper produced from cooked woods, pulped by the mechanical process, show the characteristic water-resistance qualities and hardness of hard sized papers.

Tests on papers made from steamed and unsteamed woods show that the unsteamed pulps do not give as high percentage stretch as the steamed, even though the unsteamed pulps were mixed with 20 per cent of bleached spruce sulphite. Pulps made from cooked woods should be given satisfactory beating treatments to make them usable for different purposes. Like chemical pulp, there is a marked influence on the resultant paper when the pulps are given different beating treatments. The sheets become more brittle after a prolonged beating, but give high strength tests.

THE EFFECT OF GRINDING STEAMED AND UNSTEAMED WOODS UNDER VARIABLE CONDITIONS.

SURFACE OF STONE.

There is shown in figure 9 a series of curves on steamed and unsteamed woods which were conducted on different surfaces of stone. It is evident that the horsepower consumption per ton when steamed wood is used decreases to a minimum value at a grinder pressure of approximately 65 pounds per square inch on a 14-inch cylinder, regardless of the surface which is used. The contrast in the form of the curves for steamed and unsteamed wood is shown in this same figure. Curves 2 and 3 were run under exactly the same conditions, except that in one case steamed wood and in the other unsteamed wood was used as a raw material.

Upon the condition of the surface of the pulp stone depends, to a great extent, the power consumption per ton of pulp made, the rate of production, and the quality of the resultant material. The pulp stone used in the tests was burred in many different ways, and it was generally found that if the grit were brought to the same condition of sharpness, the power consumption, rate of production, and quality of pulp would be practically the same. When the stone is rough but the sand particles are not sharp, a coarser pulp is produced which acts more free on the wire of the paper machine. It was also found that regardless of the degree of sharpness of the stone it was impossible to obtain pulp for news print if the expenditure of power remain 50 horsepower per ton.

Figure 10 shows by curves obtained at different pressures the relation of three different surfaces of stone to the power consumption per ton, power to the grinder, and production in 24 hours. These typical curves show how greatly the above-mentioned factors are influenced by varying the sharpness of the pulp stone.

Plates I and II show the effect of different degrees of sharpness of stone on the quality of pulp produced as represented by the character of fibers. Plate I, figure 1, shows the fiber produced on the sharper medium grit stone with the consumption of a small amount of power,

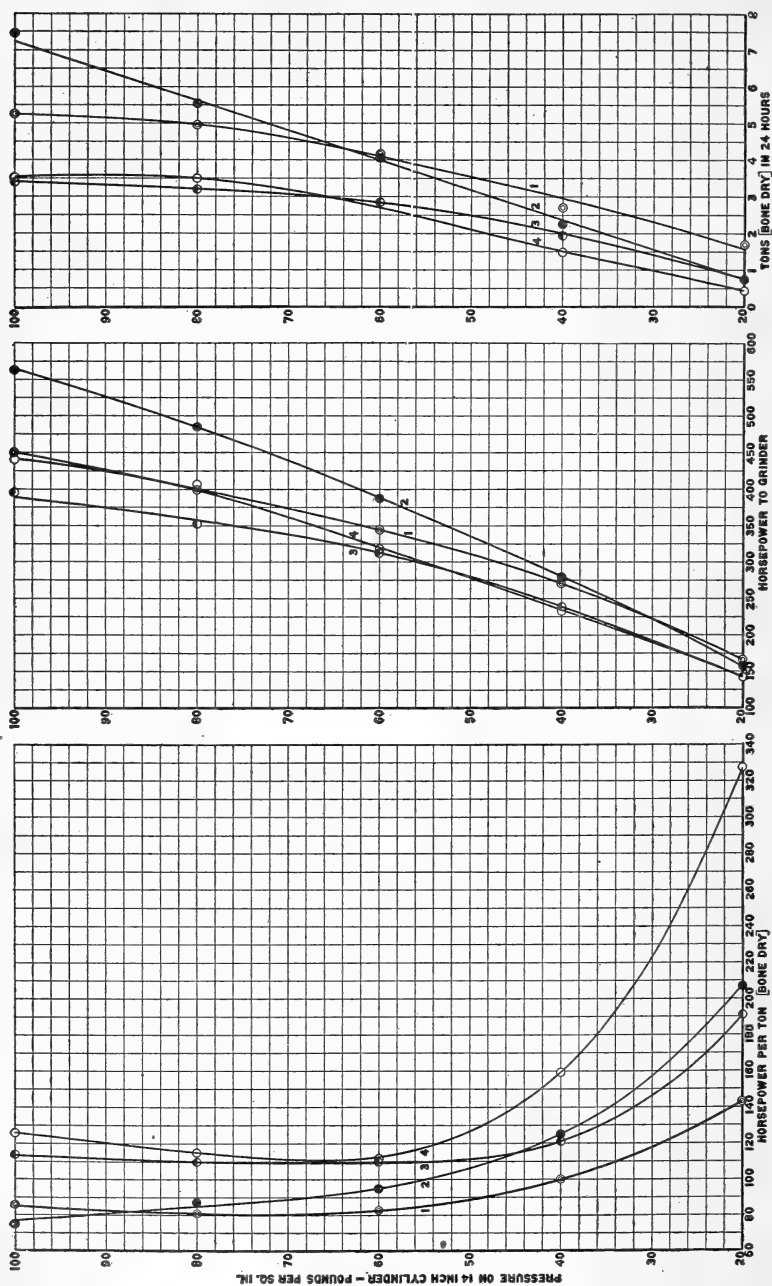


Fig. 9.—Relation of power consumption and rate of production to pressure. 1. Steamed spruce runs 182-187, inclusive. 2. Unsteamed spruce runs 177-181, inclusive. 3. Steamed spruce runs 172-176, inclusive. 4. Steamed spruce runs 167-171, inclusive.

while figure 2 shows that the consumption of a greater amount of power on a duller stone yields a much finer and better fibered pulp.

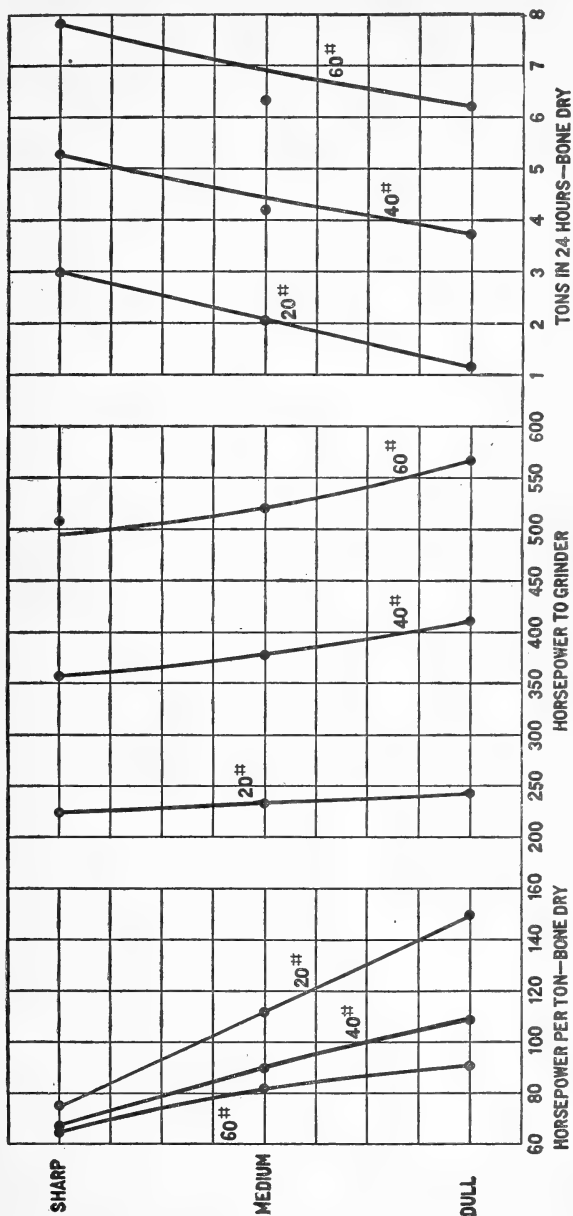


FIG. 10.—Relation of power consumption and rate of production to sharpness of stone. (Spruce runs 6 to 8, 12 to 14, and 18 to 20, inclusive.)

The fibers in Plate II, figure 1, were produced on a stone having a degree of sharpness between the above two, and those shown in figure 2 were obtained on a sharp, coarse grit stone.

GRIT OF STONE.

If a stone of coarse grit is used considerably less dressing with the burr is necessary to attain the conditions of a sharp stone. In fact, it is difficult to produce a pulp that is not coarse and full of shives. Although a somewhat lower consumption of power per ton of pulp is easily obtained, on account of its coarseness the pulp is not satisfactory from a news-print standpoint. The yield of screenings is much greater, as one would anticipate. As indicated by the Mullen tester, the strength of pulp ground on a coarse grit stone is a trifle less than when made on a finer grit stone and consuming the same amount of power per ton; but when compared as to their respective breaking lengths, there is no difference. However, when the wood is steamed prior to grinding, a strong pulp may be obtained at lower horsepower consumption on the coarse grit stone than on a finer one. A comparison of the grits of the stones may be obtained by referring to Plate III, figures 1 and 2.

In general, a stone of fine grit yields a fine-fibered pulp and a coarse stone a shivy and coarse pulp.

PRESSURE OF GRINDING.

In any commercial grinder the pressure at which the wood is forced upon the revolving grindstone—that is, the pressure per square inch of wood surface in contact—varies greatly. The variations in pressure are brought about by the binding of the wood in the pockets; the grinding of wood of different lengths and diameters; the variation of pressure on the grinder cylinder, due to the removal of pressure from one or more of the cylinders, and the use of varying amounts of split wood. For any cylinder pressure, however, it is reasonable to assume that the pressure per square inch on the stone varies between certain limits.

Figure 11 shows the relation of the pressure on the grinder cylinder, the horsepower consumption per ton, power to grinder, and production in 24 hours, the three curves being obtained on surfaces of different degrees of sharpness. It will be noted that with increasing pressure the horsepower consumption per ton decreases, and that the horsepower to the grinder and production in 24 hours increases at a fairly definite rate.

The yield and quality of pulp produced vary to a considerable degree with the pressure of grinding. Finer, although shorter-fibered, pulps are obtained when grinding at higher pressure, the advantage of the use of higher pressure being that it is possible to use a duller stone and obtain finer-fibered pulp with a consumption of the same amount of power as would be used at lower pressure and sharper condition of the stone.



FIG. 1.—SPRUCE MECHANICAL PULP (RUN No. 11).

F-LAB. 4

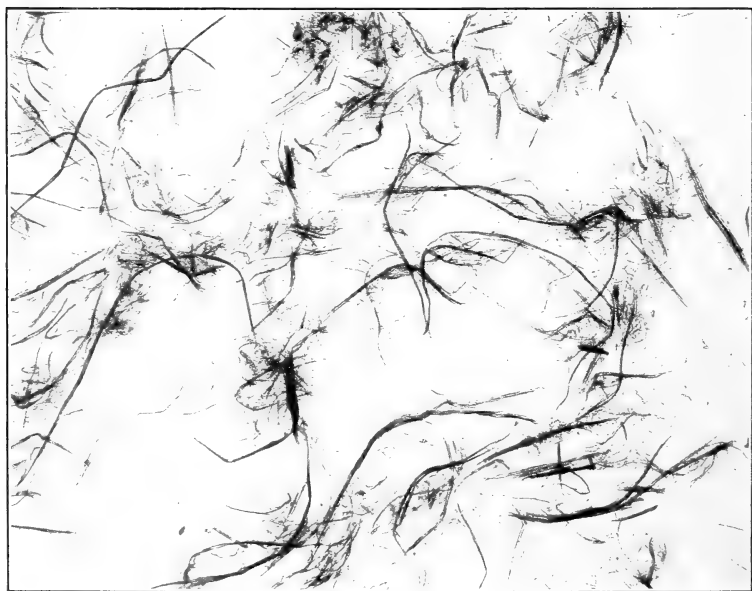


FIG. 2.—SPRUCE MECHANICAL PULP (RUN No. 5).

F-LAB. 5



FIG. 1.—SPRUCE MECHANICAL PULP (RUN No. 17).

F—LAB. 6



FIG. 2.—SPRUCE MECHANICAL PULP (RUN No. 275).

F—LAB. 7



FIG. 1.—MEDIUM GRIT PULPSTONE.

F-LAB. 8

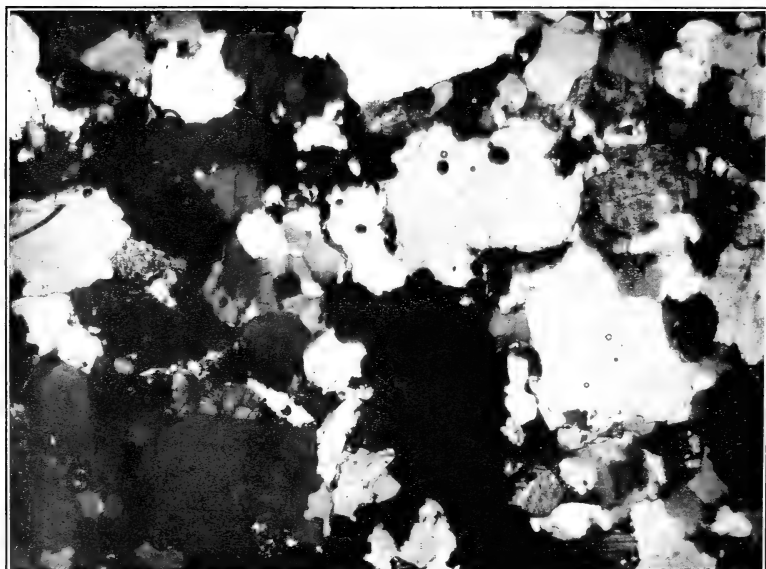


FIG. 2.—COARSE GRIT PULPSTONE.

F-LAB. 9

Figure 12 shows the effect of increasing pressure on the yield per 100 cubic feet of solid rossed wood. There is a material increase in

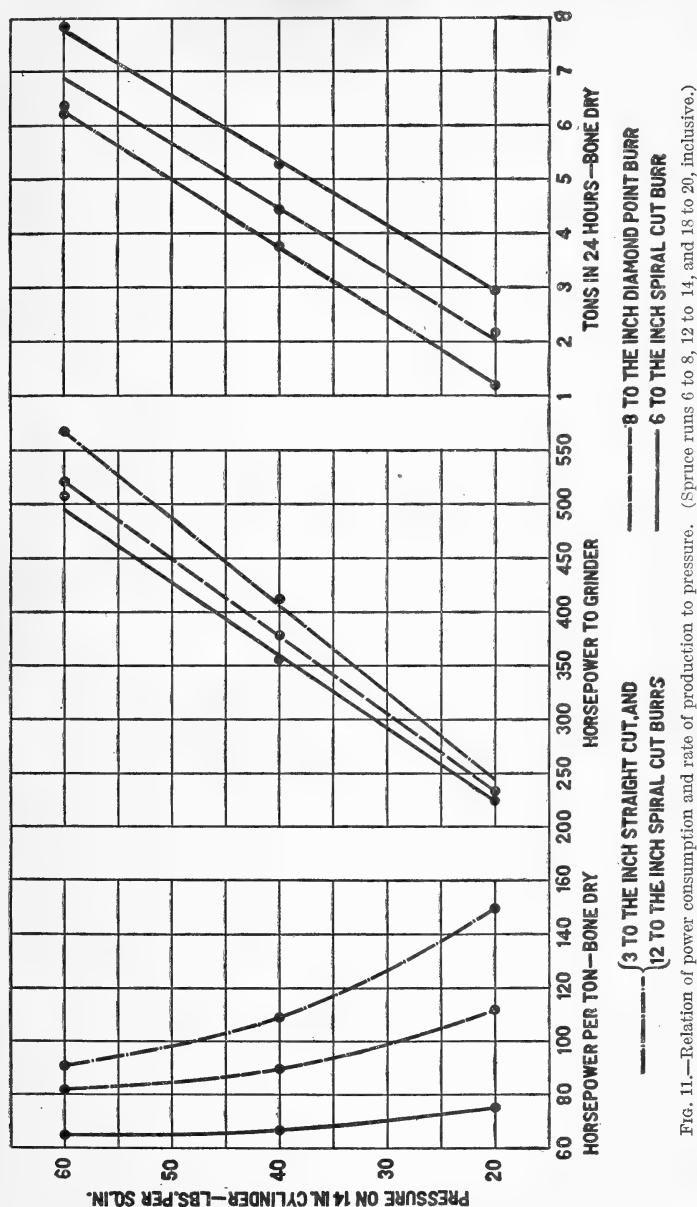


FIG. 11.—Relation of power consumption and rate of production to pressure. (Spruce runs 6 to 8, 12 to 14, and 18 to 20, inclusive.)

the amount of pulp produced from this quantity of wood if the pressure of grinding is increased from 20 pounds per square inch on a 14-inch cylinder to 100 pounds.

The effect of pressure on the quality of pulp as indicated by the strength of paper made from it is shown in figure 13. The strength factor, or bursting strength per square inch divided by the weight per ream, decreased with increasing pressure. The decrease in power consumption per ton is also shown.

PERIPHERAL SPEED OF STONE.

In figure 14 is shown the variation of the horsepower consumption per ton, horsepower to the grinder, and production in 24 hours, with

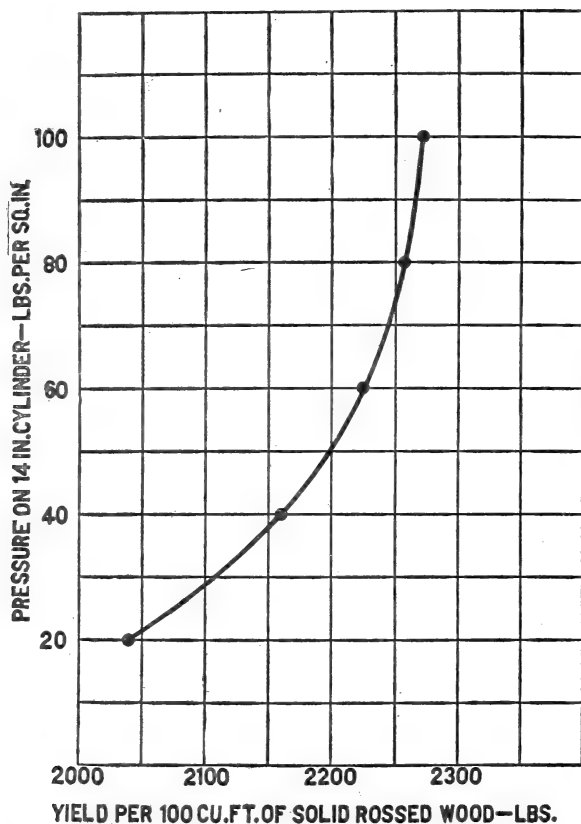


FIG. 12.—Relation of yield to pressure. (Spruce runs 52 to 56, inclusive.)

varying speed of pulp stone. The decrease in the power consumption per ton from 100 to 250 revolutions per minute when steamed wood is used is much greater than when unsteamed wood is ground under the same conditions. (See fig. 15.)

The pressure at which wood is steamed prior to grinding has a marked influence on the speed of rotation of the pulp stone necessary to consume a certain amount of power when the grinding pressure is maintained constant. This is shown in figure 16. The wood was

steamed at varying pressures for periods of three and six hours and then ground in two pockets of the grinder at a cylinder pressure of 60 pounds per square inch. The power to the grinder was maintained at 345 horsepower, and it was utilized by adjusting the periph-

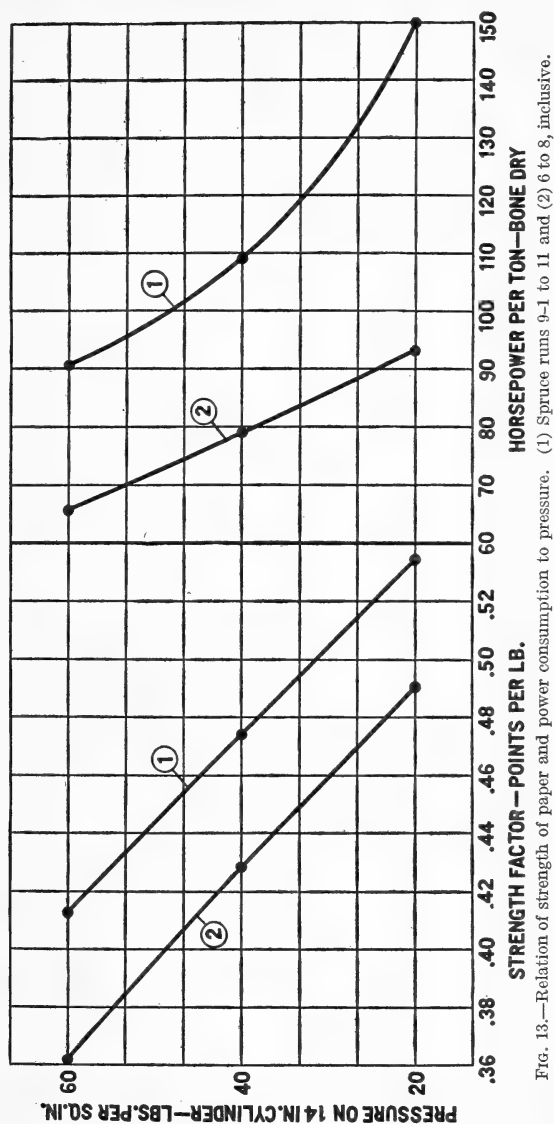


FIG. 13.—Relation of strength of paper and power consumption to pressure. (1) Spruce runs 9-1 to 11 and (2) 6 to 8, inclusive.

eral speed of the stone to such a value as was necessary for the sample being tested. When wood which had been steamed for 6 hours at 75 pounds pressure was ground a cylinder pressure of 60 pounds on two pockets and speed of 225 revolutions per minute were necessary

to consume the 345 horsepower. When the wood was steamed for 6 hours at 20 pounds, a cylinder pressure of 60 pounds and speed of 187 revolutions per minute were necessary to use up the power.

There are shown in figure 17 the relation of horsepower consumption per ton, horsepower to the grinder, and production in 24 hours to the steaming pressure when wood, which had been cooked at different pressures, was ground at constant cylinder pressure and varying speed of rotation of the pulp stone. It will be noted that the horsepower consumption per ton increases with the speed, corresponding

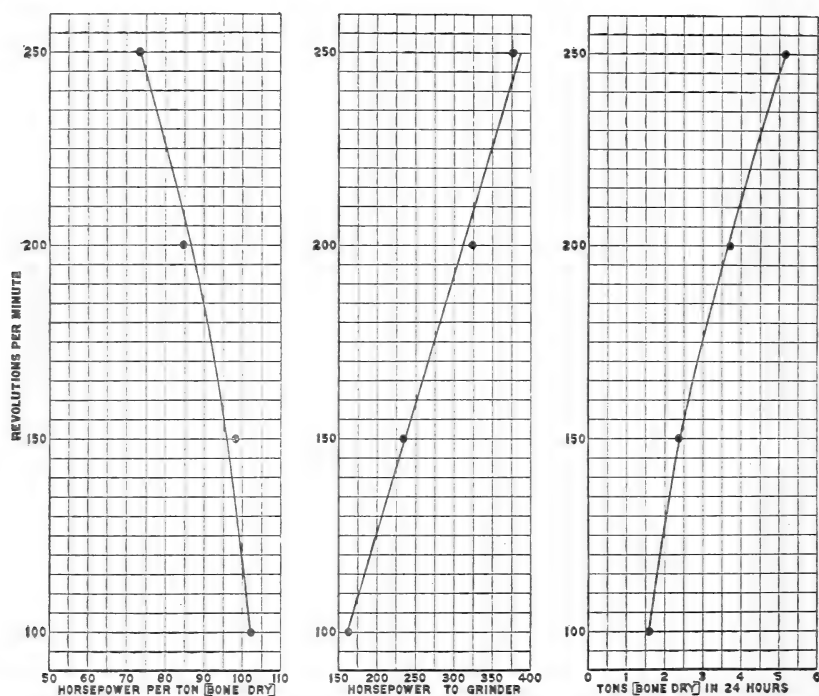


FIG. 14.—Relation of power consumption and rate of production to speed. (Spruce runs 188 to 191, inclusive.)

to increase in the pressure of steaming, and this increase is due to a reduction in the rate of production of the pulp.

When wood is steamed for a certain number of hours and at a fixed pressure, then ground with a certain amount of power to the grinder but under varying speed of rotation of the pulp stone, it is found that the horsepower consumption per ton increases in a similar manner to that given in figure 18. In other words, at low speed and high pressure more power is necessary to grind a ton of pulp in 24 hours than at high speed and low pressure. This is due, again, to the reduction in the rate of production.

The peripheral speed of the pulp stone influences the power consumption only slightly. The power consumption per ton decreases somewhat when the speed is increased (fig. 15). It is also shown that

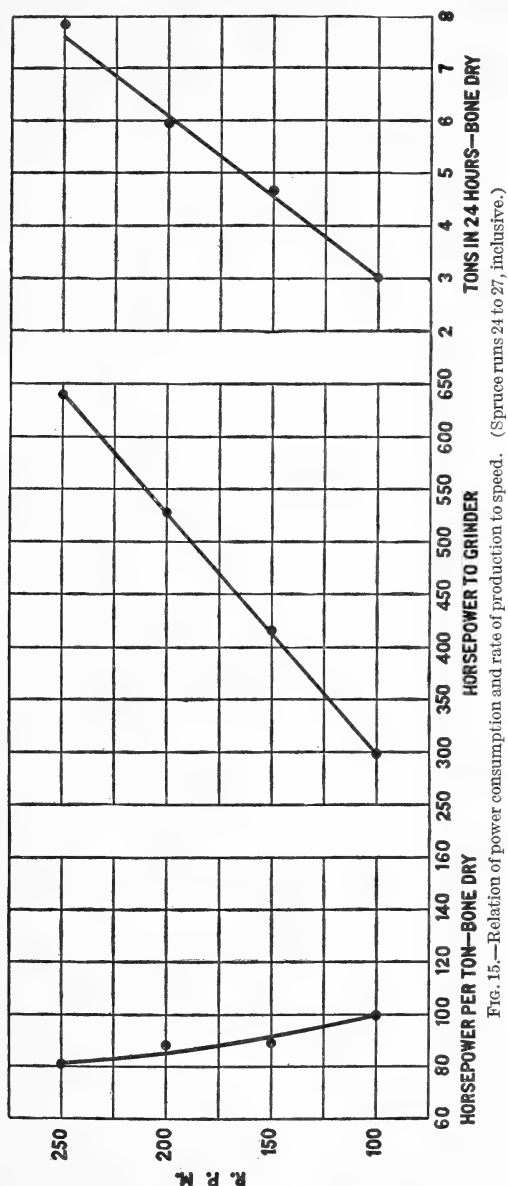


Fig. 15.—Relation of power consumption and rate of production to speed. (Spruce runs 24 to 27, inclusive.)

the horsepower to the grinder and production in 24 hours increase directly with the speed of the pulp stone. The speed has much less effect upon the quality of the pulp than either the pressure or surface

of the stone. Stronger pulp is obtained, however, at conditions of low speed and high pressure than is obtained at conditions of high speed and low pressure. It is believed, however, that the pressure is more responsible here than the speed. Figure 19 shows that the strength of paper, when the same amount of power is applied, is much less when the power is utilized at high speed and low pressure than at high pressure and low speed.

TEMPERATURE OF GRINDING.

There has always been more or less discussion about the effect of grinding hot or cold. Throughout the experimental work discussed little influence has been noted in grinding under conditions of varying temperature. It is true that the production in 24 hours is less when

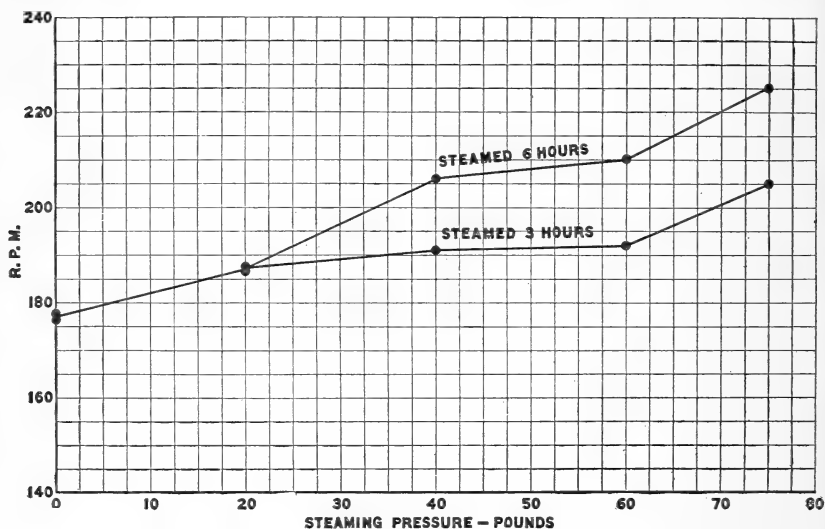


Fig. 16.—Effect of steaming pressure on speed—horsepower to grinder constant. (Spruce runs 233 to 242, inclusive.)

grinding cold than when the hot process is used, but the variation of the temperature from 125° to 190° F. does not materially influence the rate of production. The pulp is somewhat finer when ground cold, but there is not as much difference between pulps manufactured by the cold and hot processes as is generally believed.

OTHER FACTORS.

Among the other factors which influence the power consumption, production in 24 hours, and the quality and yield of pulp are the amount of seasoning the wood has undergone before grinding, the dry weight per cubic foot, the size of bolts, and the rate of growth.

It is easier to grind green wood and secure a satisfactory pulp than it is to grind seasoned wood. Seasoned wood almost invariably

yields a shorter fibered pulp, with a color inferior to that obtained from the green material. Green wood likewise requires less power to grind it, although the difference in the power consumption per ton between that obtained from green and seasoned wood is very small.

The weight per cubic foot of wood is a most important factor, since upon it depends almost entirely the yield per cord. This is best shown in figure 20, where the dry weights of a number of different species are plotted against the yield of pulp per 100 cubic feet of solid rossed wood. It has been found that the yield is almost directly proportional to the bone-dry weight per cubic foot.

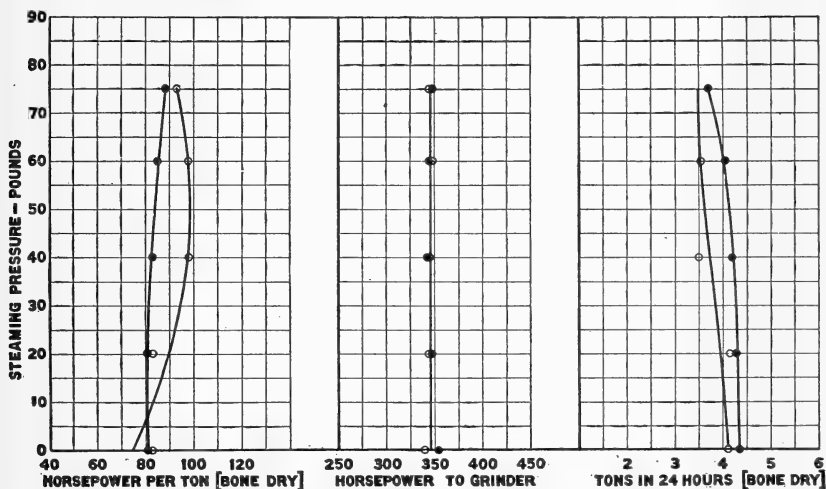


FIG. 17.—Relation of power consumption and production to steaming pressure—horsepower to grinder constant. (Spruce runs 233 to 242, inclusive.)

The following is a list of woods corresponding to the numbers shown on the curves in figure 20:

- | | |
|--------------------------------|----------------------------------|
| No. 1. Balsam fir. | No. 14. Western yellow pine. |
| 2. Red fir. | 15. Jack pine. |
| 3. White fir. | 16. Loblolly pine (fall cut). |
| 4. Alpine fir. | 17. Loblolly pine (spring cut). |
| 5. Amabilis fir. | 18. White pine. |
| 6. Lowland fir. | 19. Engelmann spruce (Montana). |
| 7. Noble fir. | 20. Engelmann spruce (Colorado). |
| 8. Eastern hemlock. | 21. Sitka spruce. |
| 9. Western hemlock. | 22. White spruce. |
| 10. Tamarack. | 23. White birch. |
| 11. Western larch. | 24. Aspen. ¹ |
| 12. Montana lodgepole pine. | 25. Black gum. |
| 13. California lodgepole pine. | |

¹ Commonly called "popple" in Wisconsin.

The rate of growth seems to have little effect upon the power consumption or rate of production. When the wood is of large diameter it is necessary to split a considerable portion of it and more or less binding is caused, this resulting in a higher power consumption per ton of pulp. The yield and quality are both slightly influenced by the rate of growth of the wood. The yield is lower from wood of rapid growth than from wood which has grown slowly. The pulp is softer when rapid-growth wood is used, although the strength is practically the same. Generally woods which are highly lignified

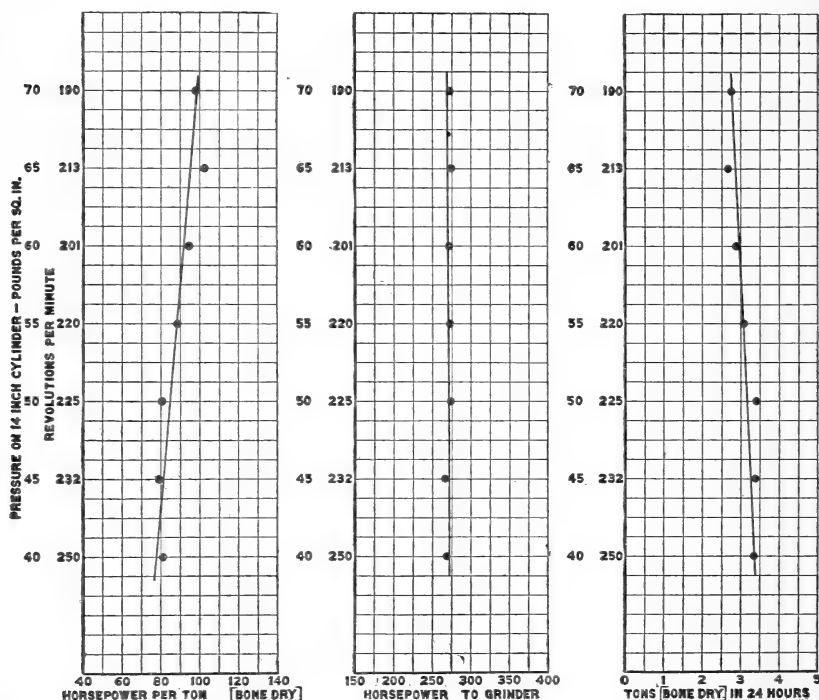


FIG. 18.—Relation of power consumption and production to pressure and speed—horsepower to grinder constant. (Tamarack runs 62 to 68, inclusive.)

yield shorter fibered pulps than those having large amounts of sapwood.

The condition of the wood as regards decay has a marked effect on the pulp. With the use of partially decayed wood the yield of pulp from a cord is greatly decreased, and while the wood grinds faster than entirely sound wood, giving an increased production and a correspondingly lower power consumption per ton of pulp, the pulp consists principally of extremely short fibers and wood flour, which greatly decrease its strength. (Spruce runs 255 and 256.) At the same time the color is materially darker than that of the pulp produced from sound wood.

POWER CONSUMPTION PER UNIT OF STRENGTH.

It has always been known that the consumption of a great amount of power will produce pulp of a greater strength. The relative effect, however, in using different amounts of power is probably best shown in figure 21. The strength as represented by Mullen or Schopper tests increases with increasing power consumption per ton.

Figure 22, curve A, shows the relation between horsepower consumption per ton of pulp per meter of breaking length of paper made

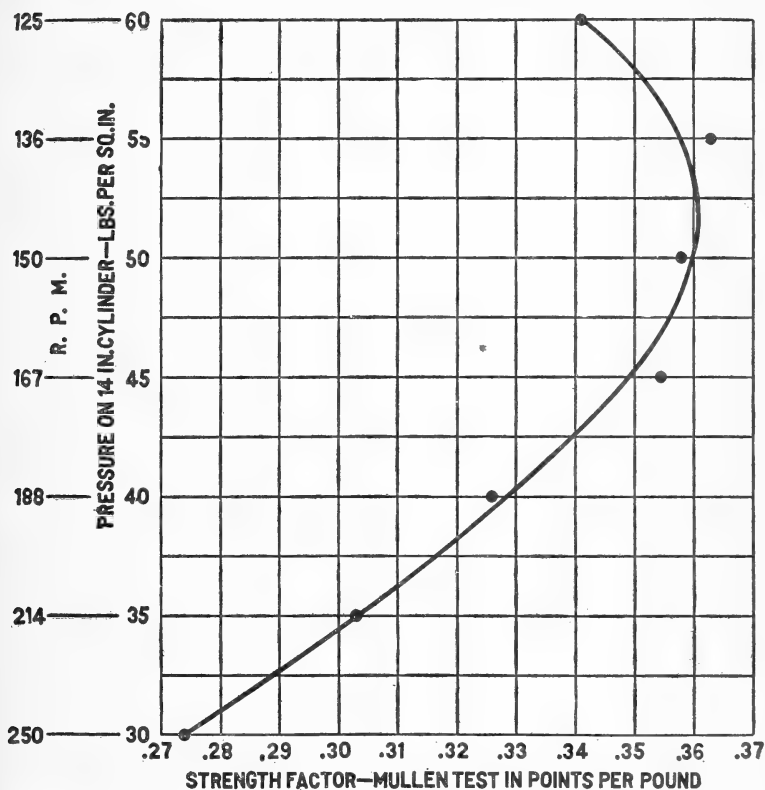


FIG. 19.—Relation of strength of paper to pressure and speed. (Spruce runs 32 to 38, inclusive.)

from it, and the power consumption in grinding a ton of the pulp. At low values of power consumption greater strength is produced per horsepower than at high values. The horsepower per ton per point per pound is also shown in the same figure, curve B.

STEAMED WOOD PULP AND ITS USES.

The pulp made by grinding steamed wood can be used for different purposes, depending largely upon the nature of the grinding process. If a sharp and coarse stone is used a large number of shives will be present and the pulp will serve for the manufacture of box board or

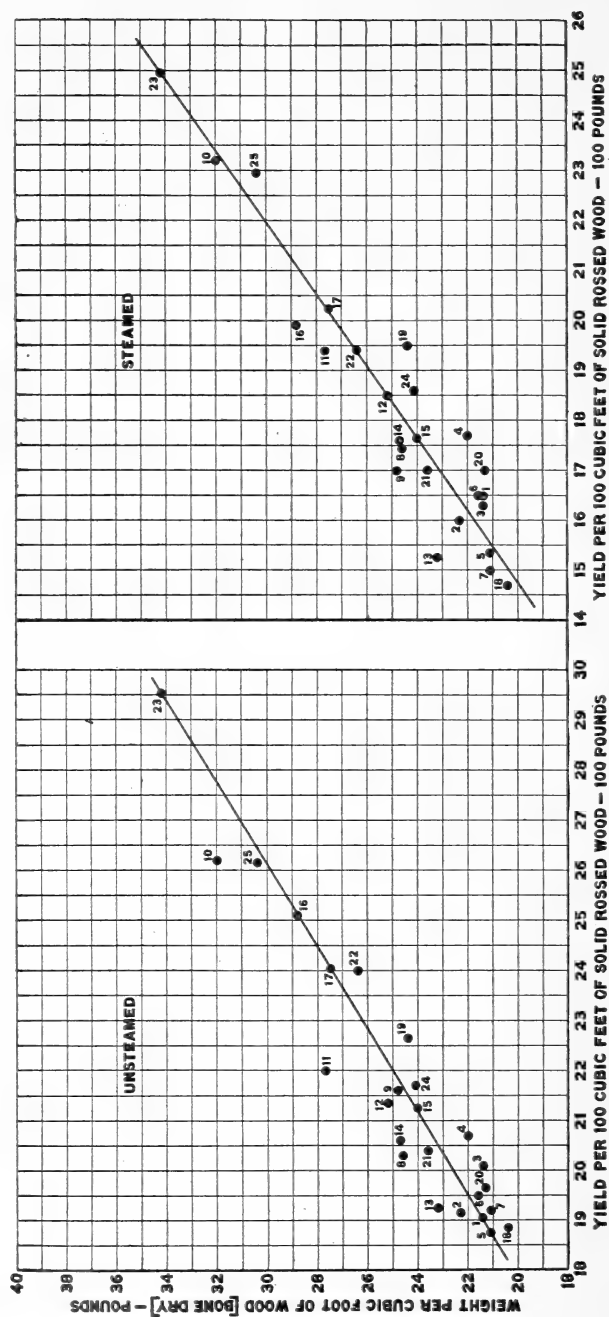


FIG. 20.—Relation of yield to dry weight of wood—steamed and unsteamed.

similar materials. When ground to a finer state, however, it has been demonstrated that with a mixture of a small amount of chemical fiber bogus kraft paper can be produced which will serve for a cheap

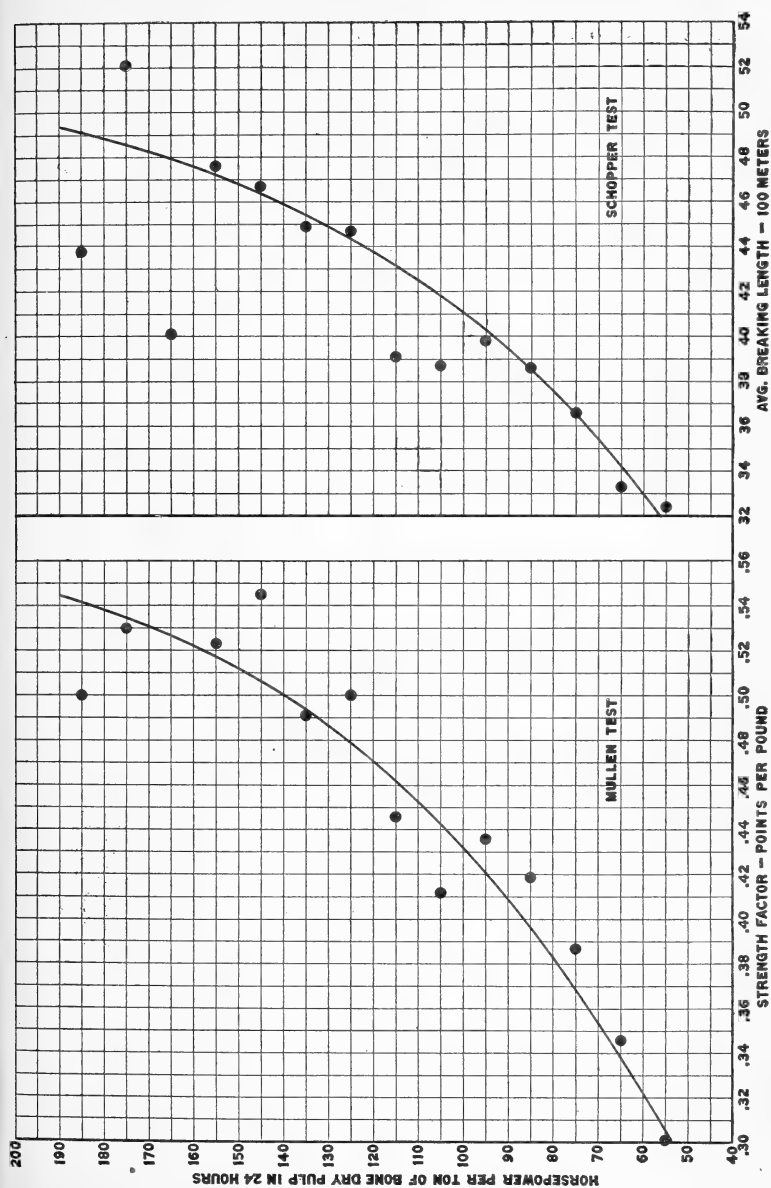


Fig. 21.—Relation of strength of paper to power consumption per ton of pulp. (Average of all tests on spruce.)

wrapping paper. It is hardly likely that spruce could be used for the manufacture of cheap wrapping paper in this manner on account of its price, but other woods, which will be discussed later, also give

remarkably good results, and, being available in large quantities, should serve as a raw material for this purpose. Tests made on sheets composed entirely of boiled and steamed ground-wood pulp show that wrapping papers which will test from 0.50 to 0.75 of a point to the pound are easily produced. Wrapping papers of this kind are inclined to be brittle and do not have sufficient strength in tearing or folding without the addition of a small amount of chemical fiber.

Resinous woods, if given a mild steaming or boiling treatment prior to grinding, are rendered much more free from pitch, although the pulp is made very soft and darkened to some extent. The use of this method for the production of news print paper would undoubt-

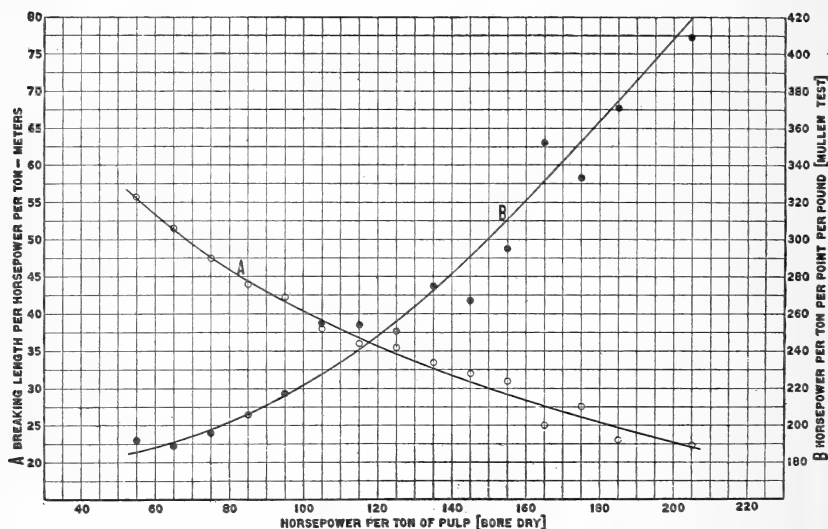


FIG. 22.—Relation of strength of paper per horsepower to power consumption per ton of pulp.

edly be costly on account of the handling necessary, the cost of steaming, and the loss in yield.

SUMMARY OF INFLUENCE OF GRINDING AND COOKING CONDITIONS IN THE PRODUCTION OF SPRUCE PULP.

The experiments conducted by the Forest Service, both in cooking spruce prior to grinding and in varying conditions of producing pulp, have led to the following conclusions:

COOKED WOOD.

(1) Cooking spruce prior to grinding results in a stronger fibered pulp, although at least 25 per cent more power per ton is required than is used in grinding untreated wood. The horsepower consumption per ton when grinding under conditions of varying cylinder pressure decreases to a minimum at approximately 65 pounds pressure on a 14-inch cylinder; this holds for dull or sharp stones.

(2) When wood is cooked under conditions of constant pressure and varying lengths of time the maximum power consumption per ton of pulp is obtained after cooking for six hours. This holds true regardless of the pressure at which the cooking takes place, between 0 and 75 pounds gauge pressure.

(3) Wood which is cooked at high pressure requires more power per ton of pulp when ground under the same conditions of cylinder pressure, speed, and surface of stone than wood which is cooked at lower pressure, if the duration of the cook is the same. Likewise, the production of pulp in 24 hours is materially less when the wood ground has been cooked at high pressure than if it had been cooked at low pressure.

(4) The yield per cord is influenced very greatly by the length of time the cooking is carried on and the pressure of the cook, being much lower for high pressures than for low and also for long cooking periods than for short.

(5) The power to the grinder increases with speed and pressure of grinding and decreases with the degree of sharpness of stone. There is also a very slight increase in the power required with increase of temperature, other conditions remaining constant, while the thickness of stock in the grinder pit has almost no influence. Under like conditions of all other factors the power to the grinder is less for steamed wood than for green or seasoned wood untreated.

(6) With a fixed amount of power to the grinder and a fixed grinding pressure, the speed of the pulp stone will vary greatly, depending on the length of time the wood has been steamed and the steaming pressure. Unsteamed wood will grind at low speed, while that steamed a long time will grind at high speed with the same amount of power to the grinder.

(7) There is little if any difference in the quality of pulp obtained as a result of using either the boiling or steaming process. The color, length of fiber, and yield are practically the same if the boiling or steaming is carried on at the same temperature.

(8) The amount of pulp produced in grinding cooked wood with a fixed amount of power to the grinder is less at high pressure and low speed than it is at low pressure and high speed. This results in a greater horsepower consumption per ton of pulp at high pressure and low speed.

UNCOOKED WOOD.

(1) The rate of production varies directly with pressure, speed, and degree of sharpness of stone. Less pulp is obtained in 24 hours using seasoned wood than with green, and still less using steamed wood, all other conditions being the same. The temperature influences the rate of production to some extent; less pulp is produced at low temperatures.

(2) The horsepower consumption per ton of pulp when untreated wood is ground increases as the pressure decreases according to a fairly definite law; it is lower on sharp stones than on dull ones, and increases as the speed decreases in much the same manner as it does with pressure. There is, however, not as much difference between the power consumption per ton at low speed and high speed as there is between power consumption at low pressure and high pressure. The power consumption is very little influenced by temperature, but it is slightly lower at high temperature. The power consumption is higher for seasoned wood than for green wood, and higher for steamed wood than for either seasoned or green material ground under the same conditions.

(3) The yield of pulp per cord is greater at high pressure than at low, and, while this is true also of the screenings, there is not as much fine material lost in white water when high pressure is used. The yield is not greatly influenced by the surface of the stone, but is slightly higher at high speed than at low. The yield is proportional to the bone-dry weight per cubic foot of wood.

(4) The quality of pulp varies greatly with the surface of the stone, less with the pressure, and least with the speed. The weight per cubic foot and character of wood influence quality to a marked extent, especially the latter; temperature also has a marked influence; pulp of greater strength is obtained at higher temperature; pulp produced at low temperature will take a better finish. Pulp of better color can be obtained from green wood than from seasoned, and stronger pulp can be obtained by cooking the wood prior to grinding. The quality of paper manufactured under exactly the same conditions, but made of pulp produced at different grinder pressures, varies greatly with the grinder pressure and the horsepower consumption per ton of pulp. Mechanical pulp of greatest strength can be produced only by the expenditure of a relatively large amount of power.

PART II.—SUBSTITUTES FOR SPRUCE IN THE MANUFACTURE OF GROUND-WOOD PULP.

EXPERIMENTAL AND COMMERCIAL TESTS ON VARIOUS WOODS.

Grinding tests of 22 different woods were made at the Wausau laboratory. Samples of the experimental pulps were sent to the Madison laboratory for tests to determine their quality. The experimental apparatus and the methods of operation were the same as those used in the case of spruce and described in Forest Service Bulletin 127.

In addition to the experimental tests, "commercial" tests were made of the production of pulp and of the manufacture of paper. The methods employed in the preparation of the wood and the production of pulp were identical with those in the qualitative and quantitative

tests, except that more wood was employed and more pulp produced. As a rule, 2.5 tons of bone-dry pulp were manufactured during each test, though in some cases 5 tons were made. Data were recorded on power consumption, rate of production, yield, etc., and as soon as practicable the pulp was shipped to mills in the vicinity of Wausau to be made into paper. The aim in making the paper was to produce as good a grade of news print as possible from the experimental pulps under the standard mill practice of the company to which the pulps were sent. The one divergence from this practice was in the treatment of the pulp in the beater, as in some cases different amounts and kinds of color had to be added to secure the best results. The amount of size, alum, loading, color, etc., was recorded for each beater of pulp, as also were the amounts of sulphite and ground wood used. The size of screen slots, speed of machine, width of wire, etc., were also recorded.

The paper produced from the experimental pulps was given a practical try out on the presses of the New York Herald and the St. Louis Republic. The tests were conducted under the ordinary operating conditions of the pressrooms of the two newspapers. The color of the different papers varied considerably, but this was not assumed to detract from their value for news-print purposes within certain limits. Record was made of the amount of waste, the number and causes of breaks, and the number of papers run from a given quantity of material. Observations were also made on the general operating conditions and the appearance of the sheet when printed. Judgment of these latter factors was left very largely to the practical pressmen.

KINDS OF WOOD TESTED.

The woods tested to determine their suitability for mechanical pulp were as follows:

| | |
|---|---|
| Balsam fir (<i>Abies balsamea</i>). | Western yellow pine (<i>Pinus ponderosa</i>). |
| Red fir (<i>Abies magnifica</i>). | Jack pine (<i>Pinus divaricata</i>). |
| White fir (<i>Abies concolor</i>). | Loblolly pine (<i>Pinus taeda</i>). |
| Alpine fir (<i>Abies lasiocarpa</i>). | White pine (<i>Pinus strobus</i>). |
| Amabilis fir (<i>Abies amabilis</i>). | Engelmann spruce, Montana (<i>Picea engelmanni</i>). |
| Lowland fir (<i>Abies grandis</i>). | Engelmann spruce, Colorado (<i>Picea engelmanni</i>). |
| Noble fir (<i>Abies nobilis</i>). | Sitka spruce (<i>Picea sitchensis</i>). |
| Eastern hemlock (<i>Tsuga canadensis</i>). | White spruce (<i>Picea canadensis</i>). |
| Western hemlock (<i>Tsuga heterophylla</i>). | White birch (<i>Betula papyrifera</i>). |
| Tamarack (<i>Larix laricina</i>). | Aspen ¹ (<i>Populus tremuloides</i>). |
| Western larch (<i>Larix occidentalis</i>). | Black gum (<i>Nyssa sylvatica</i>). |
| Lodgepole pine, Montana (<i>Pinus murayana</i>). | |
| Lodgepole pine, California (<i>Pinus murayana</i>). | |

¹ Called "popple" in Wisconsin.

TABLE 1.—Amounts of different species used and where cut.

| Kind of wood. | Ship- ment No. | Amount used. | State where grown. | County where grown. | Remarks. |
|---|----------------------|-----------------|--------------------------|--------------------------|--|
| | | <i>Cords.</i> | | | |
| Tamarack (<i>Larix laricina</i>)..... | 1 | 15 | Wis... | Lincoln..... | Swampy land, close stand. |
| Do..... | 2 | 15 | do..... | do..... | Do. |
| Jack pine (<i>Pinus divaricata</i>)... | 3 | 15 | do..... | do..... | Side hill, sloping south and east, sandy soil, close stand. |
| Do..... | 4 | 15 | do..... | do..... | Swampy land, close stand. |
| Do..... | 5 | 15 | do..... | do..... | Side hill, sloping south and east, sandy soil, close stand. |
| White spruce (<i>Picea cana- densis</i>)..... | 6 | 8 | do..... | do..... | No further description. |
| Hemlock (<i>Tsuga canadensis</i>).. | 6 | 8 | do..... | do..... | Do. |
| Jack pine (<i>Pinus divaricata</i>)... | 7 | 15 | do..... | do..... | Side hill, sloping south and east, sandy soil, close stand. |
| Do..... | 8 | 10 | do..... | do..... | Stock of Grand Rapids Paper Co. |
| Hemlock (<i>Tsuga canadensis</i>).. | 9 | 10 | Mich..... | ..... | ..... |
| Balsam fir (<i>Abies balsamea</i>)... | 9 | 2 | do..... | ..... | ..... |
| White spruce (<i>Picea cana- densis</i>)..... | 9 | 4 | do..... | ..... | ..... |
| Do..... | 10 | 20 | Wis..... | ..... | Stock of Marathon Paper Mills Co. |
| Hemlock (<i>Tsuga canadensis</i>).. | 11 | 16 | do..... | ..... | Do. |
| Do..... | 12 | 18 | do..... | ..... | Stock of Nekoosa-Edwards Paper Co. |
| Lodgepole pine (<i>Pinus mur- rayana</i>)..... | 13 | 15 | Mont. | Deerlodge..... | Slope south, 7,000 feet eleva- tion, clay soil. |
| Western yellow pine (<i>Pinus ponderosa</i>)..... | 14 | 16 | do..... | Missoula..... | Elevation 3,500 feet, glacial loam soil. |
| Red fir (<i>Abies magnifica</i>)..... | 15 | 8 | Cal..... | Nevada..... | Stock of Floriston Pulp & Paper Co. |
| Lodgepole pine (<i>Pinus mur- rayana</i>)..... | 16 | 7 | do..... | do..... | Do. |
| Western larch (<i>Larix occi- dentalis</i>)..... | 16 | 12 | Mont..... | Lincoln..... | Elevation 3,100 feet, heavy forest, dry, deep clay soil. |
| White spruce (<i>Picea cana- densis</i>)..... | 17 | 8 | Wis..... | Price..... | Stock of Nekoosa-Edwards Paper Co. |
| Balsam fir (<i>Abies balsamea</i>)... | 17 | 8 | do..... | do..... | Do. |
| White spruce (<i>Picea cana- densis</i>)..... | 18 | 18 | do..... | do..... | Do. |
| Aspen (<i>Populus tremuloides</i>)... | 19 | 8 | do..... | do..... | No other data available. |
| White birch (<i>Betula papy- rifera</i>)..... | 19 | 11 | do..... | do..... | Do. |
| White spruce (<i>Picea cana- densis</i>)..... | 20 | 16 | do..... | do..... | Stock of Nekoosa-Edwards Paper Co. |
| Western hemlock (<i>Tsuga heterophylla</i>)..... | 21 | 8 | Wash..... | Chehalis..... | Aberdeen Chamber of Com- merce. |
| Sitka spruce (<i>Picea sitchensis</i>).. | 21 | 8 | do..... | do..... | Do. |
| White spruce (<i>Picea cana- densis</i>)..... | 22 | 18 | Wis..... | Price..... | Stock of Nekoosa-Edwards Paper Co. |
| Lodgepole pine (<i>Pinus mur- rayana</i>)..... | 23 | 9 | Cal..... | ..... | Stock of Floriston Pulp & Paper Co. |
| Red fir (<i>Abies magnifica</i>)..... | 23 | 9 | do..... | ..... | Do. |
| White spruce (<i>Picea cana- densis</i>)..... | 24 | 15 | Wis..... | Price..... | Stock of Nekoosa-Edwards Paper Co. |
| Balsam fir (<i>Abies balsamea</i>)... | 25 | 8 | do..... | do..... | Do. |
| White pine (<i>Pinus strobus</i>)... | 25 | 8 | do..... | do..... | Do. |
| Engelmann spruce (<i>Picea engelmanni</i>)..... | 26 | 6 | Colo..... | (Cochetopa Nat. For.) | Elevation 9,200 feet, deep black soil. |
| White fir (<i>Abies concolor</i>)..... | 27 | 17 | Cal..... | Plumas..... | Elevation 3,220 feet, red clay and shale soil. |
| Amabilis fir (<i>Abies amabilis</i>).. | 28 | 8 | Wash..... | Whitcom..... | Elevation 2,150, fragmentary rock soil. |
| Lowland fir (<i>Abies grandis</i>).... | 29 | 5½ | Mont..... | Missoula..... | Elevation 3,400 feet, sandy loam. |
| Alpine fir (<i>Abies lasiocarpa</i>)... | 29 | 6 | do..... | do..... | Elevation 3,300 feet, sandy loam. |
| Engelmann spruce (<i>Picea engelmanni</i>)..... | 29 | 5 | do..... | do..... | Elevation 3,300 feet, gravelly loam. |
| White spruce (<i>Picea cana- densis</i>)..... | 30 | 10 | ..... | ..... | Stock of Nekoosa-Edwards Paper Co. |
| Loblolly pine (<i>Pinus taeda</i>)... | 31 | 6 | N. C..... | ..... | Stock of Beaver Co., Weldon, N. C. |
| Black gum (<i>Nyssa sylvatica</i>)... | 32 | 5 | La..... | Winn..... | Hard wood bottoms. |
| Tamarack (partially decayed). | 33 | ½ | ..... | ..... | Selected from culls of stock of Marathon Paper Mills Co. |
| Noble fir (<i>Abies nobilis</i>)..... | 34 | 6 | Oreg..... | Multnomah... | Elevation 3,500 feet, rocky soil. |

The region in which the different species grow is shown on the maps, figures 23 to 44. Table 1 gives source of shipments tested. Information concerning the amount of each kind of timber available



FIG. 23.—Balsam fir (*Abies balsamea*).

and other facts relating to the stand and supply will be furnished by the Forest Service upon request.

RESULTS OF GRINDING TESTS.

On the whole, very little difficulty was encountered in producing pulp from the woods tested. With the conifers, at least, grinding could be done under practically the same conditions employed for

spruce. All the substitutes, however, with the possible exception of noble fir and amabilis fir, required the use of more power per ton of pulp. Also, while a good grade of spruce pulp can be produced under widely varying conditions of grinding, the best results were generally obtained from the other woods when the stone was somewhat dull, the pressure high, and the speed of grinding rather slow.



FIG. 24.—Red fir (*Abies magnifica*).

Such pulp is as light in color as, if not lighter than, spruce, and a fairly sharp stone can be used in grinding it. Seasoned wood, however, usually shows decay and insect attack, and it is practically impossible to grind it into pulp which will not contain many shives and be somewhat soft. The yield from balsam fir is about 1,910 pounds (bone-dry pulp) per hundred cubic feet of solid rossed wood, or approximately 490 pounds less than the yield from an equal quantity of white spruce.

Red fir, like balsam, is easily ground to a pulp satisfactory for news-print purposes. It required, however, more power per ton of pulp, due possibly to the fact that the wood used in the experiments was of such a large diameter that it had to

THE FIRS.

The firs tested were balsam fir (*Abies balsamea*), red fir (*Abies magnifica*), white fir (*Abies concolor*), amabilis fir (*Abies amabilis*), alpine fir (*Abies lasiocarpa*), lowland or grand fir (*Abies grandis*), and noble fir (*Abies nobilis*).

A good sheet of pulp can easily be obtained from balsam fir if the wood is in a green state.

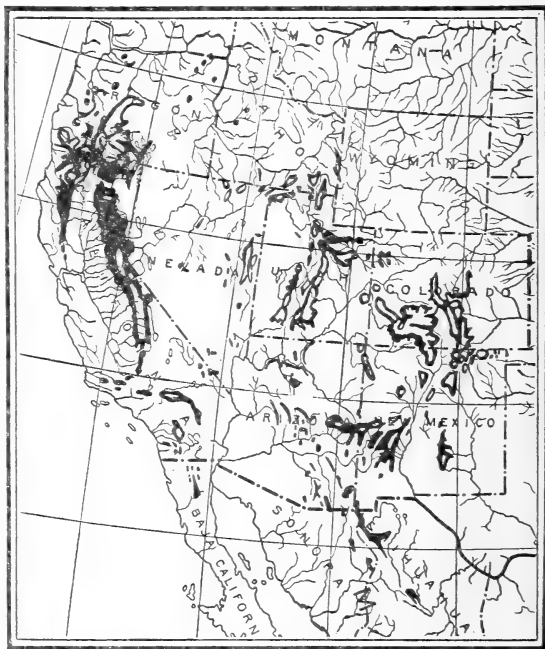


FIG. 25.—White fir (*Abies concolor*).

be split before it could be ground. The pulp had a reddish tinge, which made it less suitable for news-print purposes than that of some other woods which grow in the same region. The yield was approximately 1,915 pounds (bone dry) per hundred cubic feet of solid rossed wood, or nearly 500 pounds less than for white spruce. On the basis of a cord of rough wood the difference in yield would be even greater on account of red fir's extremely thick bark.

White fir yields a very satisfactory pulp, especially when the wood is green and comes from young trees. Tests conducted on this species, to note the influence of age of the trees on the quality of the pulp produced, showed that pulp from the split wood of trees 40 inches in diameter and 130 feet high was inferior in color, fiber, and yield to pulp obtained from trees of 18 inches in diameter or less. Pulp obtained from the older wood was inclined to be soft and shivy; that from the younger wood did not show these defects. The color of white-fir pulp is better than that of red fir, though not as good as that of balsam. White-fir pulp is rather soft. The yield is approximately 2,000 pounds (bone dry) per hundred cubic feet of solid rossed wood, or about 400 pounds less than white spruce.

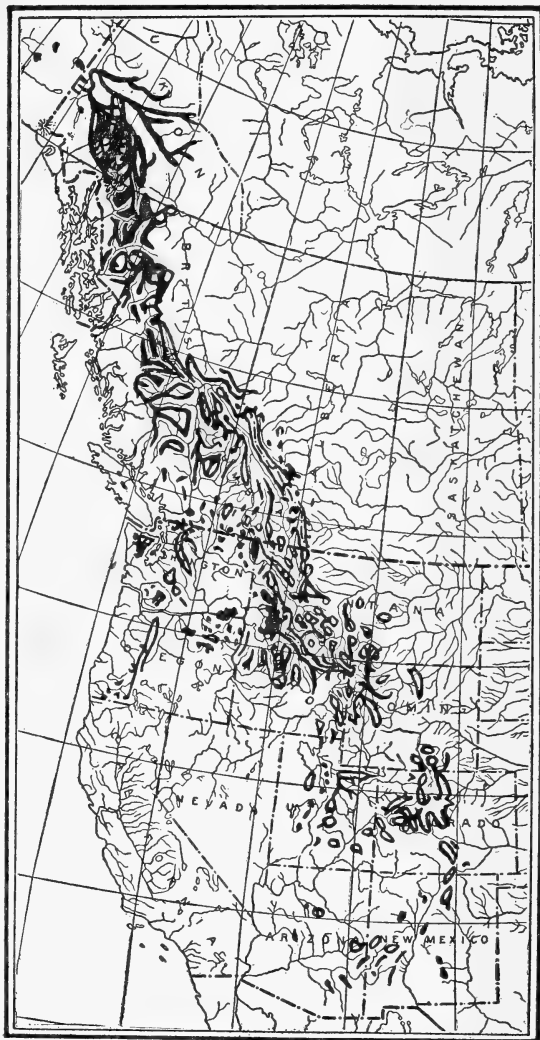


FIG. 26.—Alpine fir (*Abies lasiocarpa*).

Alpine fir yields a very good quality of pulp, which in color is as light as, if not lighter than, spruce pulp. It can be ground with a

fairly sharp stone and without an unusual expenditure of power. The result is a pulp very satisfactory for news-print purposes. The yield is approximately 2,060 pounds (bone dry) per hundred cubic feet of solid rossed wood. This wood is usually free from knots and other irregularities, and has a fairly thin, smooth bark.

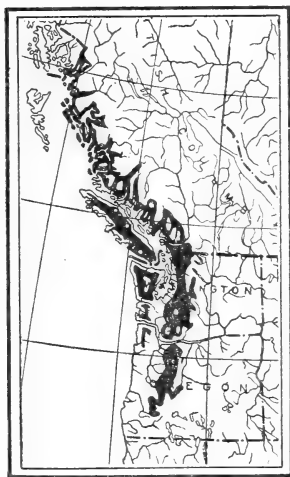


FIG. 27.—Amabilis fir (*Abies amabilis*).

Amabilis fir readily grinds to a pulp suitable for news-print purposes. The color of the pulp is slightly grayish, but an excellent fiber can be produced with a sharp stone and a reasonable amount of power. In strength the pulp is about equal to that obtained from spruce. The wood used in the tests was split from large logs having a number of good-sized knots. The yield is approximately 1,870 pounds (bone dry) per hundred cubic feet of solid rossed wood. As in the case of red fir, the thick bark of amabilis fir would result in decreasing the yield were the latter figured on the basis of a rough-piled cord.

Lowland or grand fir can be ground on a fairly sharp stone to produce pulp well adapted for news-print paper. The quality is not up to that of balsam or amabilis fir, but is better than that of white, alpine, or red fir. The pulp produced at the laboratory had a slightly grayish cast, which in some measure might be due to the heart rot that was beginning to attack many of the logs. The yield was approximately 1,950 pounds (bone dry) per hundred cubic feet of solid rossed wood.

Noble fir readily yields a pulp satisfactory for news-print purposes. Like white spruce, it can be ground with a wide variation of power consumption. The pulp has a marked pinkish tinge, which is objectionable, but the fibers are of unusual length and strength, though with a tendency to coarseness. The wood tested was supplied from a large tree freshly cut and was remarkably free from knots. The yield was approximately 1,920 pounds (bone dry) per hundred cubic feet of solid rossed wood, or about 480 pounds less than that from an equal amount of spruce.

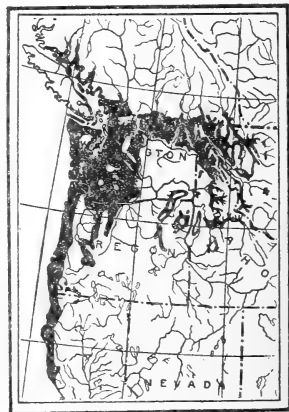


FIG. 28.—Lowland fir (*Abies grandis*).

THE HEMLOCKS.

Eastern hemlock (*Tsuga canadensis*) requires a considerable amount of power for the production of satisfactory pulp. The wood must also be of fairly small diameter and of very good quality. Even under the best conditions, eastern hemlock pulp does not present a good appearance; the fibers are short, and it has a decided reddish tinge. Moreover, it is very hard to produce pulp which will not crack along the edges when the laps are folded. However, even with the handicap of short fibers, a pulp satisfactory for news-print purposes can be produced. The yield from eastern hemlock is approximately 2,030 pounds per hundred cubic feet of solid rossed wood (370 pounds less than from an equal amount of white spruce), though the same ratio would not be evident if the basis were a cord of rough wood.

Western hemlock (*Tsuga heterophylla*) can be ground at much higher pressures and with a sharper stone than eastern hemlock. The pulp produced is of very good quality and aside from its grayish color compares well with white spruce. It is far superior to that from eastern hemlock. The yield is about 2,160 pounds per hundred cubic feet of solid rossed wood, or 240 pounds less than that from white spruce, though the bark of western hemlock is much heavier than that of the latter species.

THE LARCHES.

Tamarack (*Larix laricina*) produces a very good quality of pulp with a reasonable amount of power. In color, however, the pulp is a decidedly grayish green. It would probably serve for news-print paper if used with spruce sulphite or mixed with spruce ground wood. In any event, it could be used for wrapping paper. The yield is approximately 2,620 pounds per hundred cubic feet of solid rossed wood, or about 220 pounds more than from an equal amount of white spruce.

Western larch (*Larix occidentalis*) yields a very inferior pulp. The product is difficult to operate on the wet machine, and the pulp stone must be rough, but not sharp, to secure the best results. In other words, the pulp must have coarse fibers and a relatively large number of shives. The color, a decided brown, is objectionable. The yield from western larch was only 2,100 pounds per hundred cubic feet of solid rossed wood, though on the basis of the dry weight of the wood it should have been at least 2,300 pounds. This difference is probably due to the high proportion of the wood substance that is soluble in water and to the brittleness of the heartwood, so that a large percentage of the yield is lost in the white water.



FIG. 29.—Noble fir (*Abies nobilis*).

THE PINES.

Both the California and Montana lodgepole pine (*Pinus murrayana*) yield pulp of very good quality. The wood can be ground under ordinary conditions and does not require the consumption of a large amount of power. Satisfactory results are obtained when the wood is ground at high pressures and at high speed, provided the stone is somewhat dull. The color of the pulp from both varieties compares favorably with that of white spruce, though the Montana wood is somewhat lighter than the California. The resin did not prove objectionable. Montana lodgepole pine yielded

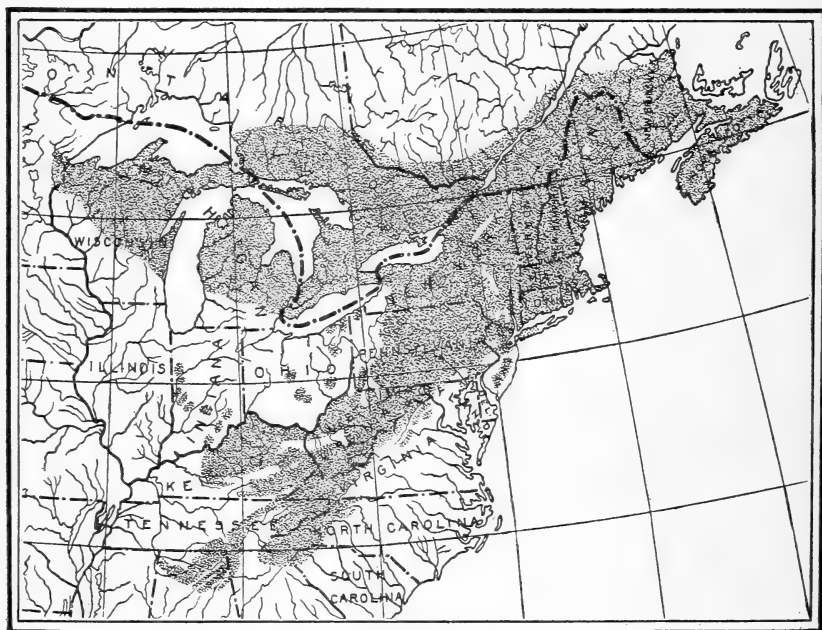


FIG. 30.—Eastern hemlock (*Tsuga canadensis*).

approximately 2,140 pounds of pulp (bone dry) per hundred cubic feet of rossed wood, while California trees yielded about 1,920 pounds. The difference was due to the greater age, larger size, and lighter weight of the California wood.

Western yellow pine (*Pinus ponderosa*) can be ground under a wide variety of conditions. The pulp has a fairly long, coarse fiber and is invariably soft. In color it tends toward a creamy, resembling to some extent that obtained from jack pine. While the wood used in the test contained considerable pitch, this did not cause much trouble either in the grinding process or in the operation of the wet machine. The wood used was cut in October, and it is reasonable to suppose that material cut after the sap had gone down would

have been better. The fact that the majority of the tests were made after the wood had seasoned from one to one and one-half years might also account for the more satisfactory operation of the material. The yield was approximately 2,060 pounds per hundred cubic feet of solid rossed wood.

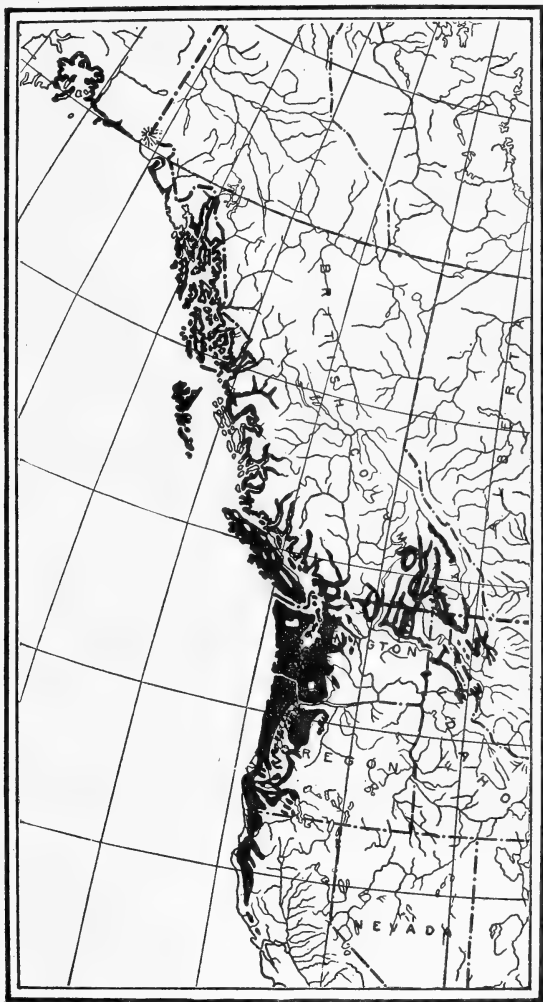


FIG 31.—Western hemlock (*Tsuga heterophylla*).

Jack pine (*Pinus divaricata*) yields a very good pulp when ground with a rather dull stone, necessitating, of course, a high power consumption. The pulp produced at a consumption of from 90 to 100 horsepower per ton for 24 hours compares favorably with white spruce pulp made with a somewhat lower power consumption. In

color jack pine is creamish or even brownish, and the pitch may cause trouble on the felts, especially if the wood is not seasoned or has not been ponded for a considerable period of time. The best results can be obtained from pitchy woods if the trees are cut when the sap is down. The yield of jack-pine pulp per hundred cubic feet of solid rossed wood was about 200 pounds less than that from an equal amount of white spruce.

Loblolly pine (*Pinus taeda*) requires a dull stone and consequently an expenditure of a large amount of power, but does not yield a pulp of as good a quality as may be obtained from the other pines

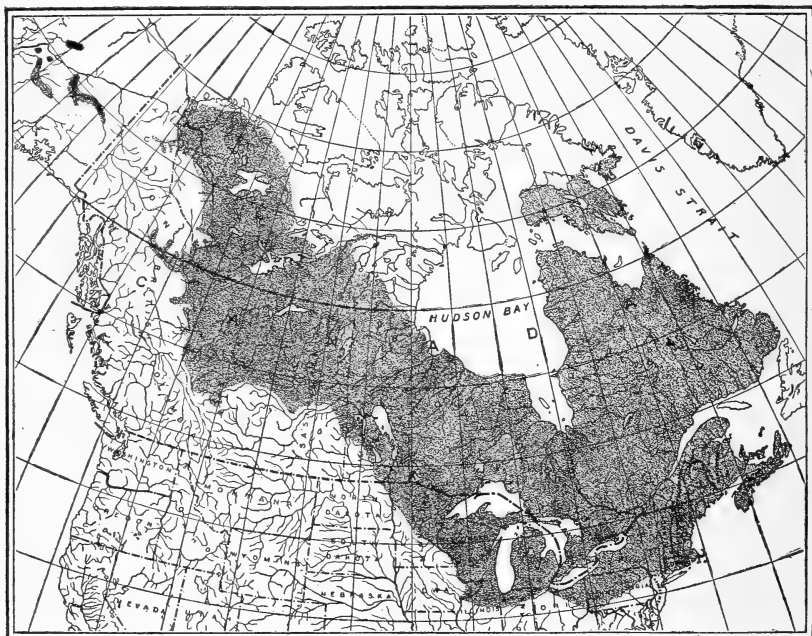


FIG. 32.—Tamarack (*Larix laricina*).

tested. Although hardly suitable for news-print purposes, loblolly-pine pulp could no doubt be used as a filler. Tests were made on wood cut in the spring and allowed to remain in the forest until the bark became loosened and on wood cut in the fall and split for firewood. The fall-cut wood produced a creamy colored pulp, while the spring-cut wood gave one of a brownish shade. Practically no other difference was noted in the quality. The yield from the fall-cut wood was about 2,500 pounds per hundred cubic feet of rossed wood, while that from the spring-cut wood was 2,400 pounds, the amount in each case being proportional to the weight per cubic foot of the wood.

Through a mistake in shipment a quantity of white pine (*Pinus strobus*) was received at the laboratory. It had not been the intention to test this wood, since its value for lumber eliminates it from consideration as a possible substitute for spruce. Tests were made on it, however, since it was at hand. It can be ground on a fairly sharp stone to yield fibers of good strength and excellent color. The pulp contains a considerable amount of pitch, and, like that from the other pines, is inclined to be soft. The yield was approximately 1,885 pounds per hundred cubic feet of solid rossed wood.

THE SPRUCES.

Engelmann spruce (*Picea engelmanni*) can be ground under the same conditions used for white spruce. The pulp has an excellent color and a long strong fiber. The fact that the wood ground at the laboratory was in a green state undoubtedly made it easier to produce a good grade of pulp. Wood obtained from Colorado in the form of small logs showed no difference in quality from similar material obtained from Montana, though the latter, owing to its greater weight per cubic foot, yielded about 2,250 pounds of pulp (bone dry) per hundred cubic feet of rossed wood against 2,000 pounds for the Colorado material.

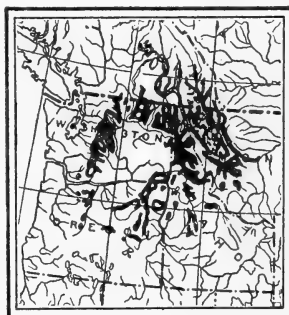


FIG. 33.—Western larch (*Larix occidentalis*).

Sitka spruce (*Picea sitchensis*) yields a pulp of very good quality, though not equal to that from white spruce. Although the wood can be ground under practically any condition of speed, sharpness of stone, and grinder pressure, the fibers are not as fine and long as those of the white spruce. In color, moreover, Sitka spruce pulp is inclined to be grayish. The wood tested was cut during the latter part of April and contained considerable pitch. It undoubtedly would have run better had it been cut earlier in the year. The yield was 2,100 pounds per hundred cubic feet of solid rossed wood, or about 200 pounds less than that from an equal amount of white spruce.

THE HARDWOODS.

Aspen (*Populus tremuloides*) requires the consumption of a large amount of power to produce pulp which will run satisfactorily on the wet machine. If the pulp stone is too sharp or a less amount of power is used, the pulp will be very short. When mixed with spruce, however, it operates very satisfactorily. Aspen pulp possesses good

color, although it is likely to contain black specks of bark unless knots are removed from the wood before it is ground. The yield was approximately 2,200 pounds per hundred cubic feet of solid rossed wood.



FIG. 34.—Lodgepole pine (*Pinus contorta*).

White birch (*Betula papyrifera*) yields a pulp in which the fibers are short, though very fine. It is necessary to use a very dull stone in the grinding process, and even then laps crack along the edges when folded. The pulp, moreover, has a decidedly pinkish tinge, but the ground wood could undoubtedly be used as a filler in the produc-

tion of certain grades of paper. The yield per hundred cubic feet is very high, approximately 2,950 pounds, or 550 pounds more than that from an equal amount of spruce. On the basis of a rough cord, however, this difference would be materially reduced, since white birch logs have a thick bark and are often crooked.

Black gum (*Nyssa sylvatica*) yields a fiber that in many ways resembles that obtained from white birch. It is extremely short, but forms a tougher sheet than coniferous fibers of the same length. Considerable power must be expended to produce laps that can be

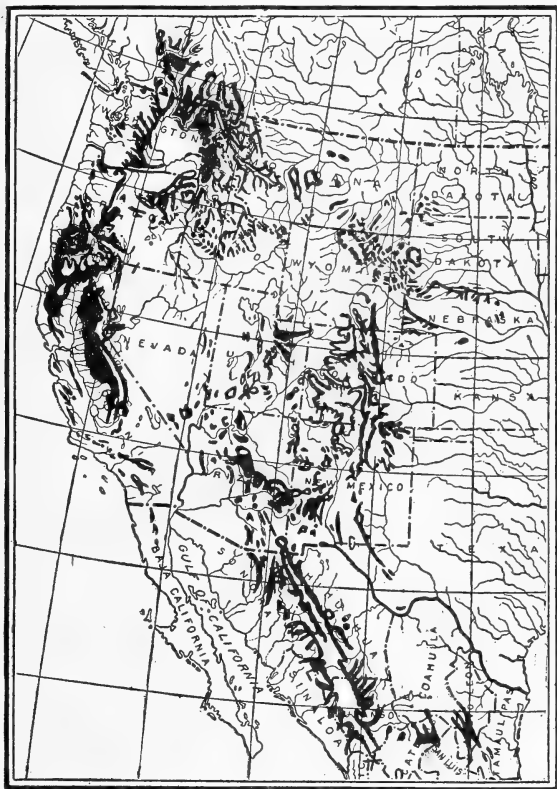


FIG. 35.—Western yellow pine (*Pinus ponderosa*).

taken off the wet machine satisfactorily. The pulp is not promising from a news-print standpoint, but could be used as a filler or mixed with pulp of a better grade. In color it is very white, ranking high in this respect among the woods tested. Steaming the wood prior to grinding gives a stronger pulp, but not to the extent observed in the case of birch similarly treated. The yield of pulp from black gum is approximately 2,600 pounds per hundred cubic feet of solid rossed wood.

WOODS STEAMED PREVIOUS TO GRINDING.

In addition to the tests on untreated wood, other tests were made on steamed material. Practically all of the conifers yielded fairly strong, brownish-colored pulps suitable for the production of board and cheap grades of brown wrapping paper. Balsam fir, noble fir, amabilis fir, Alpine fir, and white and Engelmann spruce pulps showed longer fibers and felted somewhat better than those from the other woods. When steamed all of the conifers required the consumption of a relatively large amount of power for the production of satisfactory pulps. This was not the case, however, with aspen and

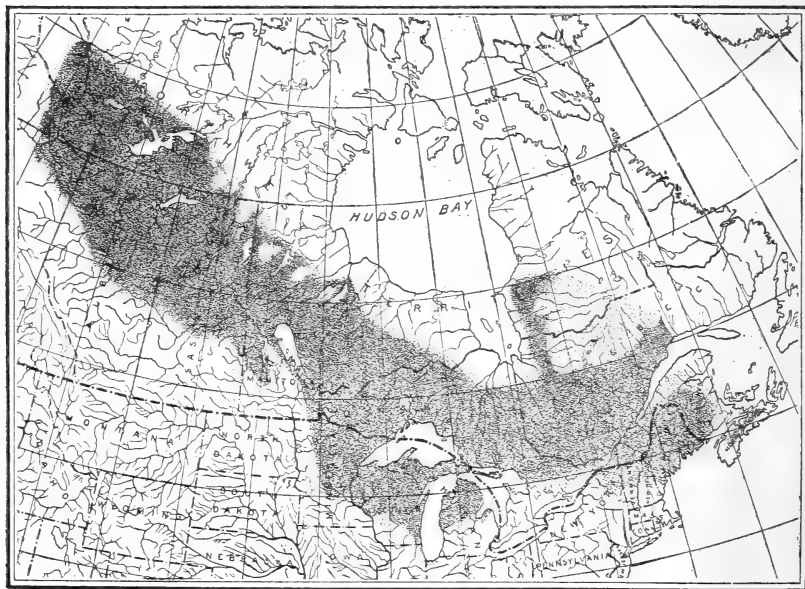


FIG. 36.—Jack pine (*Pinus divaricata*).

white birch, which produce much stronger pulps when treated before grinding, the product comparing favorably in color and toughness with spruce pulp. The fibers of the aspen and white birch were shorter, it is true, than those of spruce, but the felting qualities of the hardwood pulps are better than those of spruce pulp. Steamed aspen and white birch can be ground with a comparatively small amount of power to produce the kind of pulp just described.

A heavy loss in wood substance was noted in the case of all the species tested except western larch. The fibers of the latter wood seem to become tougher as the result of cooking and do not grind up to a fine powder which passes through the meshes of the cylinder mold.

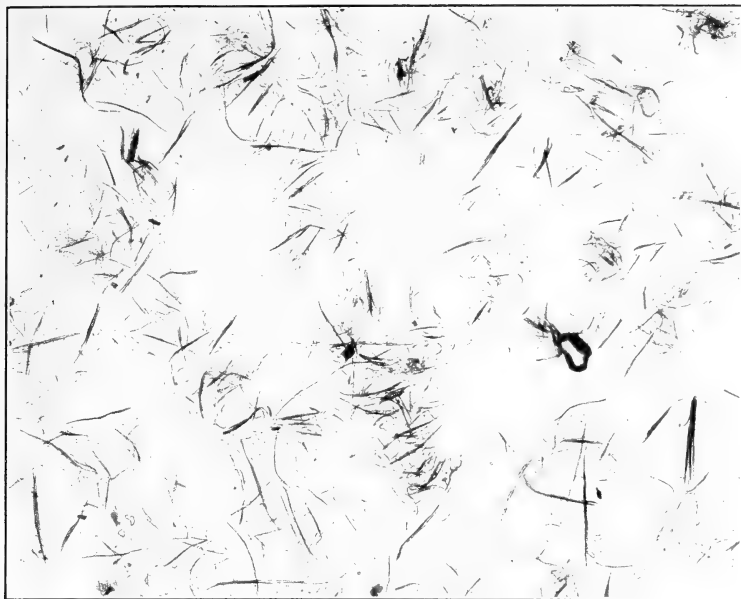


FIG. 1.—UNSTEAMED (RUN No. 2).

F—LAB. 10



FIG. 2.—STEAMED (RUN No. 3).

F—LAB. 11

WHITE BIRCH MECHANICAL PULP.

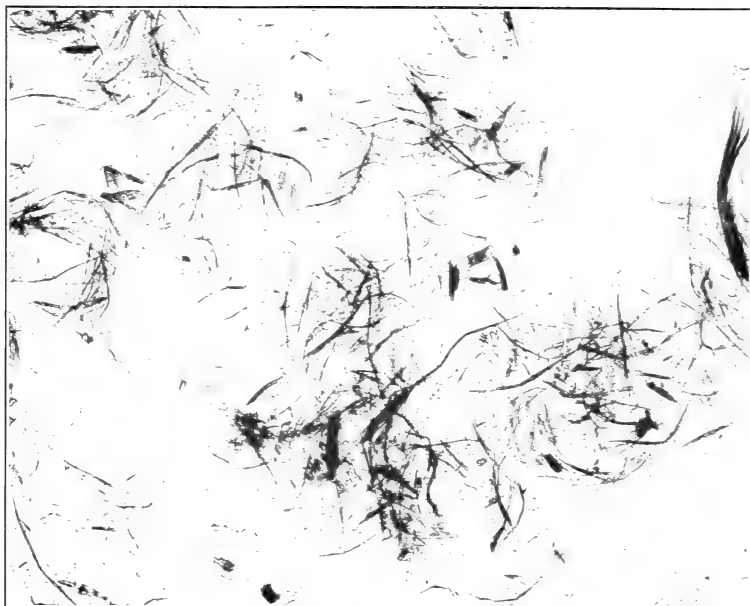


FIG. 1.—STEAMED (RUN No. 5).

F-LAB. 12



FIG. 2.—UNSTEAMED (RUN No. 2).

F-LAB. 13

ASPEN MECHANICAL PULP.



FIG. 1.—UNSTEAMED (RUN NO. 56).

F—LAB. 14



FIG. 2.—STEAMED (RUN NO. 62).
HEMLOCK MECHANICAL PULP.

F—LAB. 15



FIG. 1.—STEAMED (RUN No. 30).

F-LAB. 16



FIG. 2.—UNSTEAMED (RUN No. 27).

F-LAB. 17

JACK PINE MECHANICAL PULP.

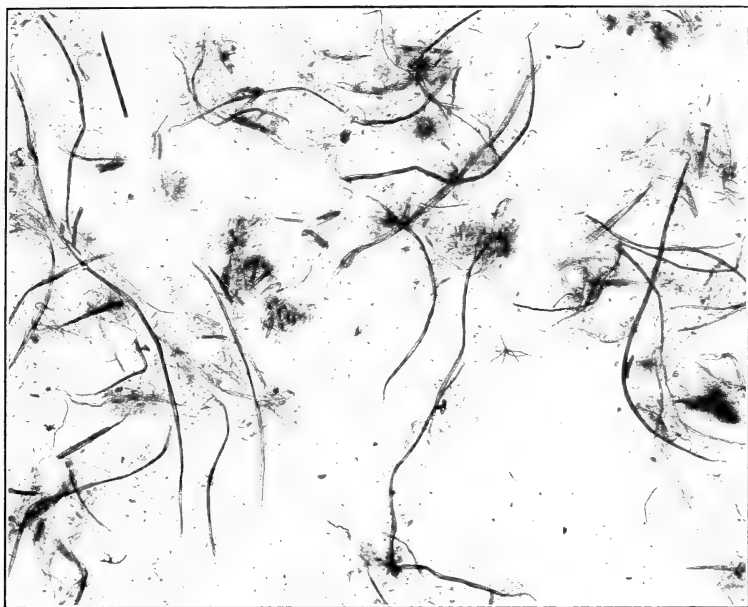


FIG. 1.—STEAMED (RUN No. 25).

F-LAB. 18



FIG. 2.—UNSTEAMED (RUN No. 26).

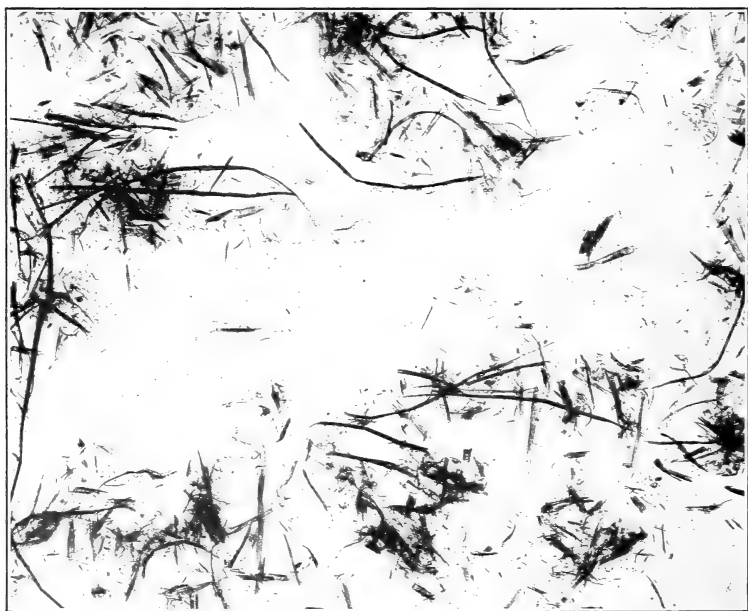
F-LAB. 19

TAMARACK MECHANICAL PULP.



F-LAB. 20

FIG. 1.—RED FIR MECHANICAL PULP UNSTEAMED (RUN NO. 4).



F-LAB. 21

FIG. 2.—WESTERN LARCH MECHANICAL PULP UNSTEAMED (RUN NO. 2).



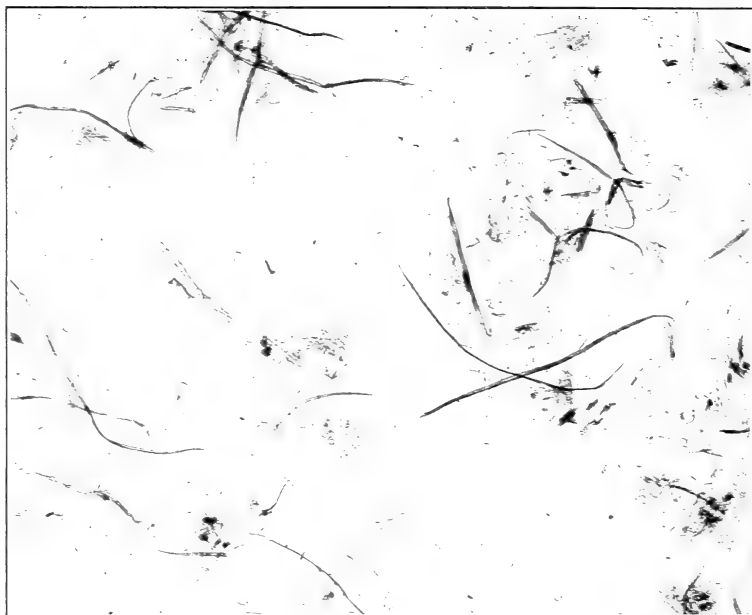
F-LAB. 22

FIG. 1.—WESTERN HEMLOCK MECHANICAL PULP UNSTEAMED (RUN NO. 1).



F-LAB. 23

FIG. 2.—LODGEPOLE PINE (CALIFORNIA) MECHANICAL PULP UNSTEAMED (RUN NO. 2).



F-LAB. 24

FIG. 1.—WESTERN LARCH MECHANICAL PULP STEAMED (RUN No. 1).



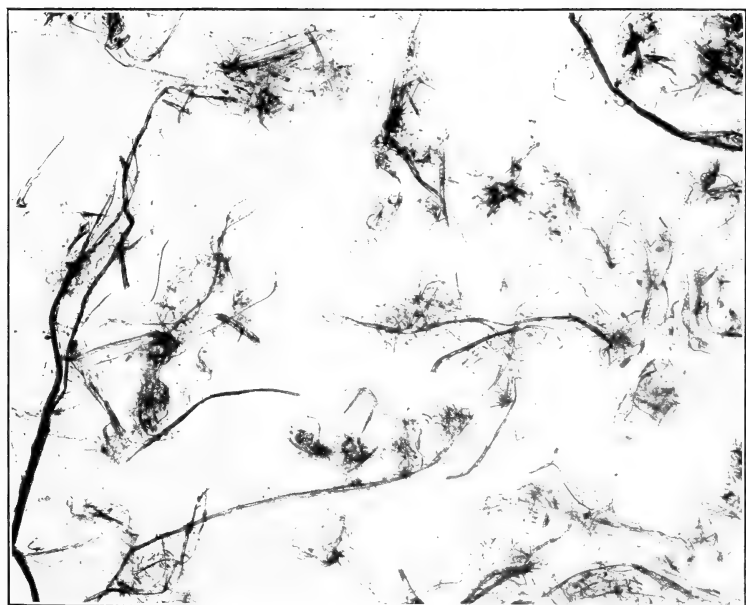
F-LAB. 25

FIG. 2.—LODGEPOLE PINE (CALIFORNIA) MECHANICAL PULP STEAMED (RUN No. 1).



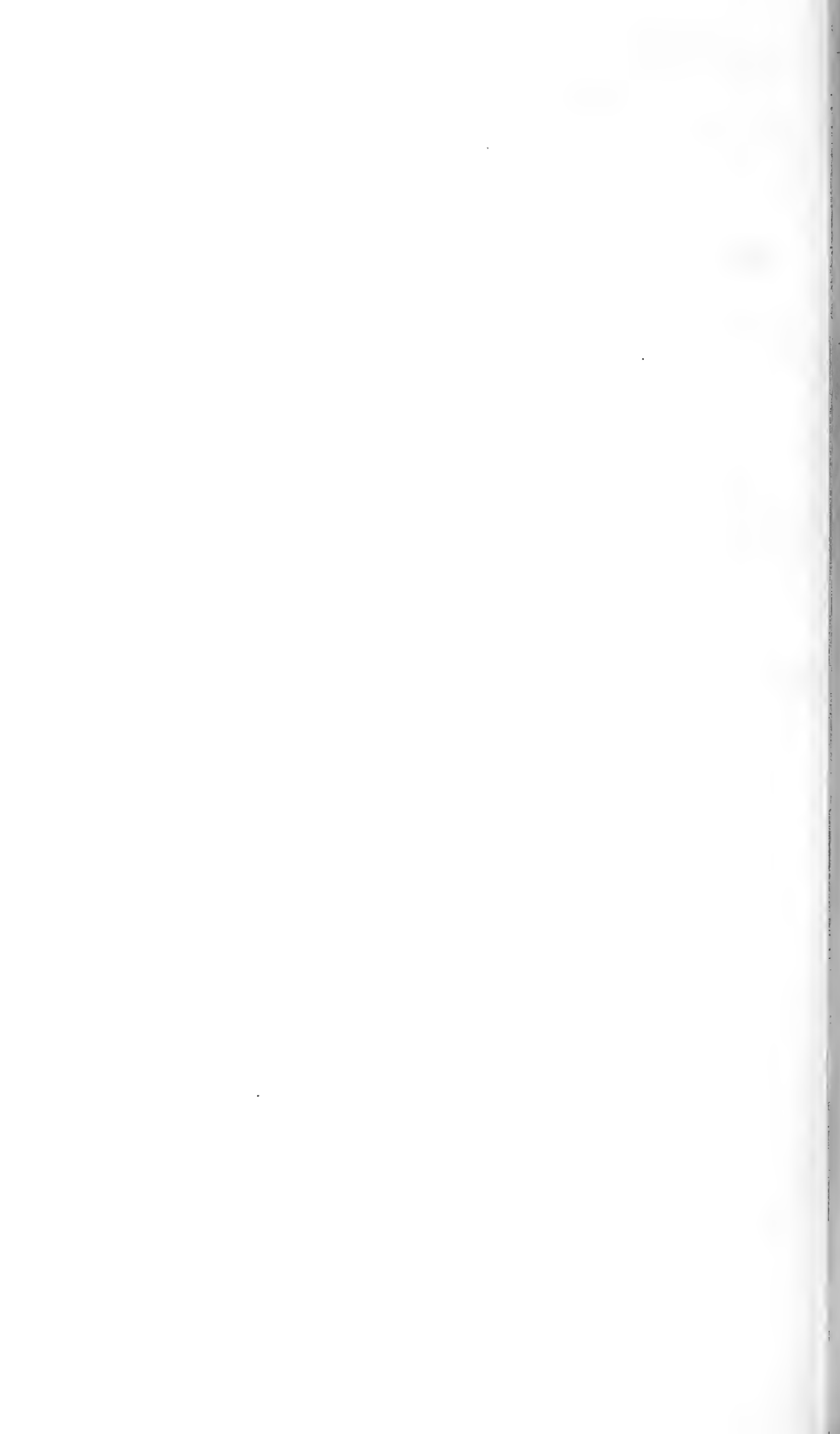
F-LAB. 26

FIG. 1.—BALSAM FIR MECHANICAL PULP UNSTEAMED (RUN NO. 14).



F-LAB. 27

FIG. 2.—NOBLE FIR MECHANICAL PULP UNSTEAMED (RUN NO. 2).



MICROSCOPIC COMPARISON OF GROUND-WOOD FIBERS.

Plates IV to XII are photomicrographs of the ground-wood fibers obtained from the various species tested. It is not possible, of course, to gauge accurately from such photographs the pulp-making qualities of the fibers. Length of fiber does not necessarily mean strength, for a stronger pulp can be obtained from fibers which, though quite short, will felt well. Steamed white birch pulp, for example, will test as high in strength as longer-fibered material from the pines, larches, and hemlocks. However, the photographs make it possible to compare the characteristics of the fibers of one kind of wood with those of another kind, especially since the lodgepole pine,



FIG. 37.—Loblolly pine (*Pinus taeda*).

western hemlock, western larch, red fir, balsam, white birch, jack pine, hemlock, and tamarack were ground under the same conditions of pressure, speed, surface of stone, etc. For some of these species photographs of both cooked and uncooked fibers are shown. The cooked-wood specimens were not treated in the same manner, nor were they ground under like conditions.

In the case of birch (Pl. IV) it will be seen that the uncooked pulp is very short and contains much wood flour, while the cooked fibers are fairly long and very fine. When run into paper without the addition of sulphite the steamed pulp showed a strength under test of 0.51 point per pound and 5.8 points per thousandth inch of thickness.

The aspen fibers (shown in Pl. V) appear to be even shorter than those of the birch. The steamed pulp when run into a 63-pound sheet gave a Mullen test of 0.51 point per pound and 6.2 points per thousandth inch of thickness.

Between the cooked and uncooked hemlock fibers (shown in Pl. VI) there is more contrast in respect to length than in the case of birch and poplar. The cooked hemlock when run into a 55-pound sheet without sulphite gave a Mullen test of 0.51 point per pound and 6 points per thousandth inch of thickness.

Both the steamed and unsteamed jack pine (shown in Pl. VII) are remarkably free from wood flour and short fiber. The steamed-

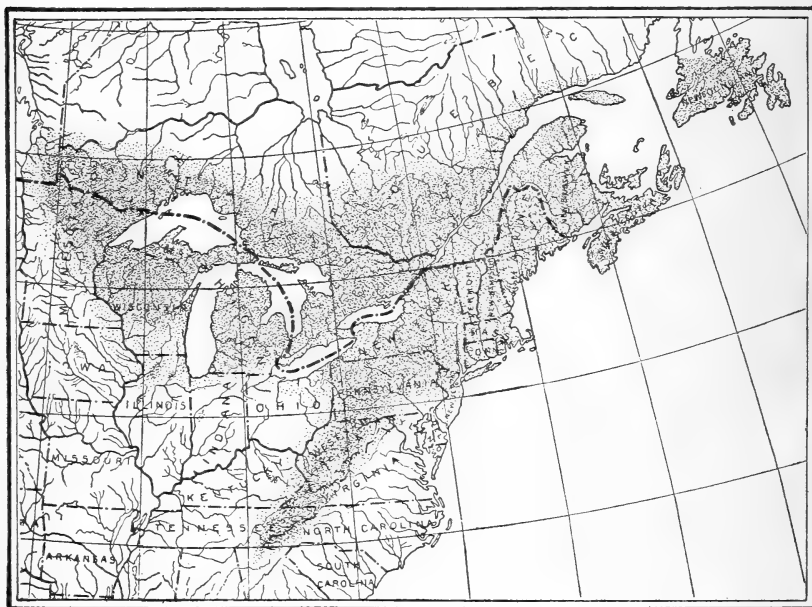


FIG. 38.—White pine (*Pinus strobus*).

wood sample, when run into a 43-pound sheet without sulphite, gave a Mullen test of 0.47 point per pound and 4.5 points per thousandth inch of thickness.

In Plate VIII, which shows steamed and unsteamed tamarack fibers, the much greater length of the former is apparent.

Plates IV, VI to X, and XII, figure 1, show the fibers from a number of different woods ground in the natural state under the same conditions. With the exception of western larch, the fibers are of very good quality and compare well with those of spruce. So far as length and fineness go, the fibers shown in Plates VII, X, and XII are fully equal to spruce.

EXPERIMENTAL MANUFACTURE OF PAPER.

A limited amount of paper (waterleaf) was made experimentally at the Madison laboratory from the various pulps and tested for strength and color. In every case the conditions of manufacture were identical, and no coloring matter was added to any of the pulps in the beater. The paper machine used was too small to permit of

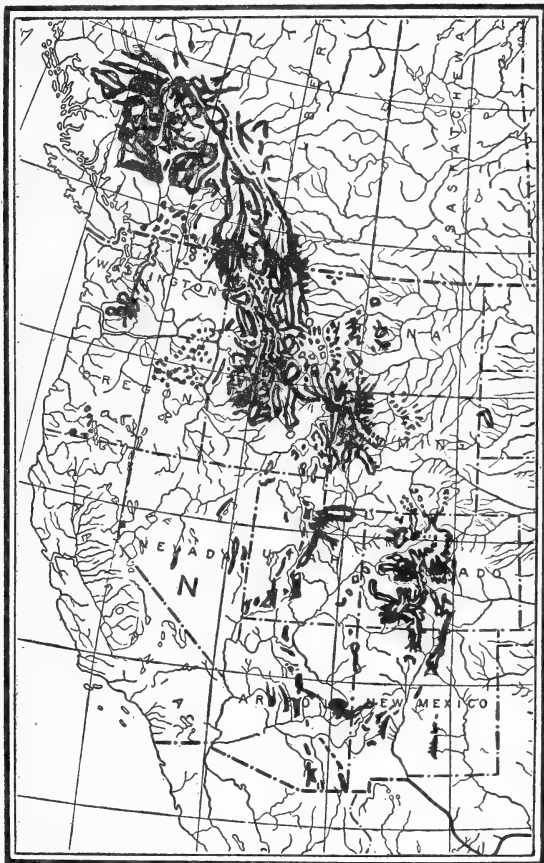


FIG. 39.—Engelmann spruce (*Picea engelmanni*).

reliable data being obtained upon such points as operation of the pulp on the machine, calendering, and the like.

In the matter of color the various wood fibers (unsteamed) may be arranged in the order given below, the basis being the number of parts of black which each sample contained, that with the smallest number ranking first. It should be remembered that the arrangement is made as the result of tests on many different samples of paper from the same wood, rather than on the particular samples

which accompany this bulletin, and also that the different woods were in various stages of seasoning when ground into pulp, a fact which might materially influence their relative color rating:

- | | |
|--------------------------------|--|
| 1. Alpine fir. | 14. Jack pine. |
| 2. White spruce. | 15. White fir (old and young trees mixed). |
| 3. Engelmann spruce. | 16. Noble fir. |
| 4. Black gum. | 17. Loblolly pine (spring cut). |
| 5. Lowland fir. | 18. Aspen. |
| 6. Montana lodgepole pine. | 19. White birch. |
| 7. Loblolly pine (fall cut). | 20. Sitka spruce. |
| 8. White pine. | 21. Eastern hemlock. |
| 9. Balsam fir. | 22. Red fir. |
| 10. White fir (young wood). | 23. Tamarack. |
| 11. Western yellow pine. | 24. Western hemlock. |
| 12. California lodgepole pine. | 25. Larch. |
| 13. Amabilis fir. | |



FIG. 40.—Sitka spruce (*Picea sitchensis*).

White, Alpine, amabilis, and balsam fir are light in color, comparing very favorably in this respect with white spruce. Red fir and noble

fir, however, have a pinkish tinge, as has eastern hemlock and white birch. Western hemlock is grayish. Lodgepole pine has a good color, but western yellow pine is a yellowish white, and jack pine and loblolly have a brownish tinge. Both western larch and eastern larch

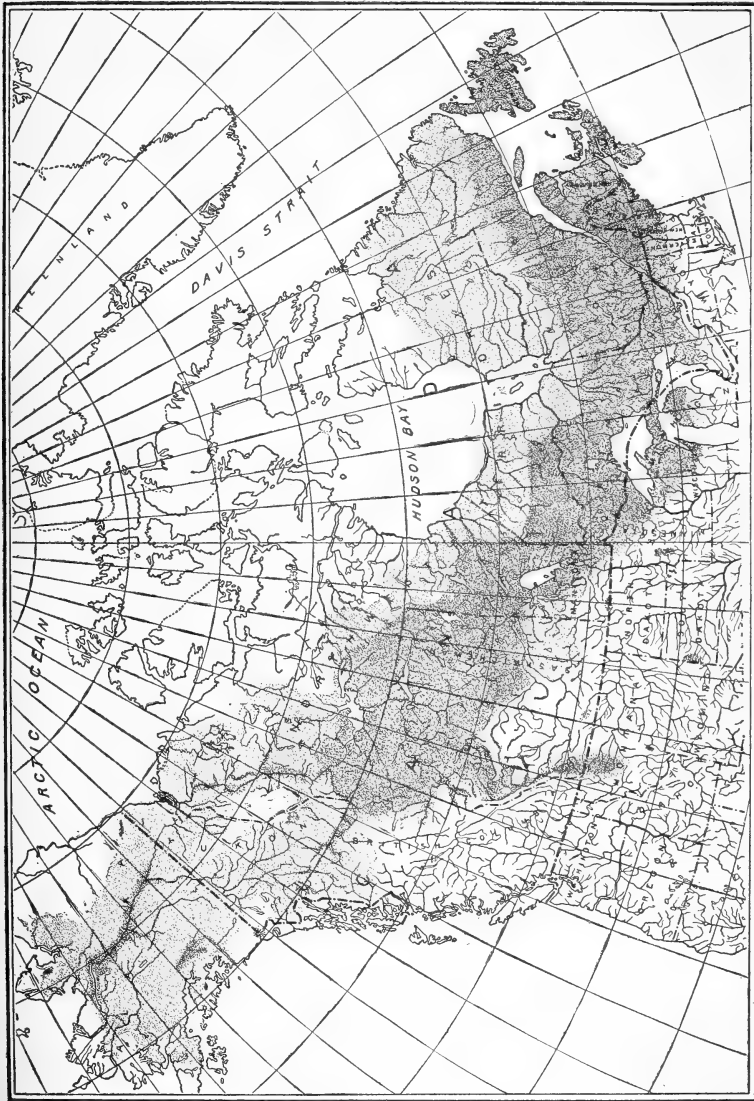


FIG. 41.—White spruce (*Picea canadensis*).

(tamarack) are of poor color for news-print purposes, the former being very brown and the latter dark gray. Aspen and black gum have a good color. Sitka spruce is gray, but Engelmann spruce is fully as bright as white spruce.

It is very difficult to obtain reliable data on the relative strength of pulps from different woods, owing to the fact that it is almost impossible to produce them under identical conditions of grinding, especially as regards power consumption per ton, a factor which largely influences their strength. The result of strength tests made at the laboratory on the experimental pulps seems to indicate, however, that but one of them surpasses white spruce pulp. This refers,



FIG. 42.—Aspen (*Populus tremuloides*).

of course, to the uncooked pulps. Tests made on the steamed pulps indicate that those from the hardwoods produced with a smaller consumption of power surpass white spruce in bursting strength. If the results of tests on the breaking length in meters per horsepower per ton and those of the horsepower per ton per point per pound are averaged for power consumptions of from 80 to 100 horsepower, the experimental woods can be arranged in the following order as regards their strength, the strongest coming first:

- | | |
|-----------------------------|--------------------------------|
| 1. Noble fir. | 13. California lodgepole pine. |
| 2. White spruce. | 14. White pine. |
| 3. Amabilis fir. | 15. Western yellow pine. |
| 4. Engelmann spruce. | 16. Tamarack. |
| 5. Western hemlock. | 17. Jack pine. |
| 6. Sitka spruce. | 18. Loblolly pine. |
| 7. Balsam fir. | 19. Hemlock. |
| 8. Lowland fir. | 20. Larch. |
| 9. Red fir. | 21. Aspen. |
| 10. Montana lodgepole pine. | 22. Black gum. |
| 11. White fir. | 23. Birch. |
| 12. Alpine fir. | |

COMMERCIAL MANUFACTURE OF PAPER.

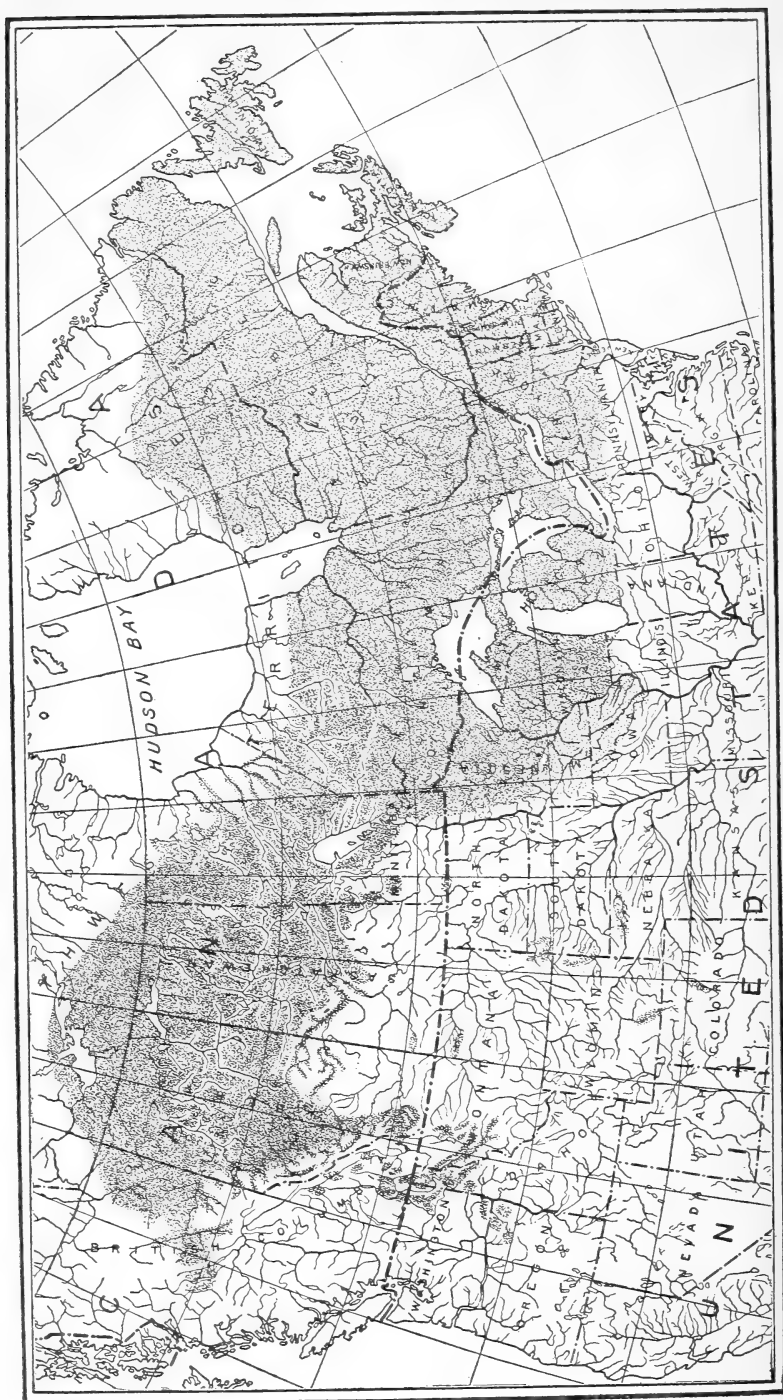
To secure reliable data on the operation of the pulps on the paper machine approximately 5,000 pounds of bone-dry pulp were manufactured from each kind of wood. At the start 5 tons of pulp were made, but it was found later that the smaller amount would be sufficient for the purpose of the test. The papers were made at the mills of the Rhinelander Paper Co., Rhinelander, Wis., and the Nekoosa-Edwards Paper Co., Port Edwards, Wis. The woods and mixtures of woods used were as follows:

- | | |
|---|--|
| Jack pine, green. | 7. California lodgepole pine. |
| Jack pine, seasoned. | 8. Red fir. |
| Hemlock. | 9. One-half spruce and one-half hemlock. |
| One-third spruce, two-thirds hemlock. | 10. One-half balsam fir and one-half spruce. |
| One-third spruce, one-third hemlock, and one-third jack pine. | 11. Tamarack. |
| Two-thirds hemlock, one-third jack pine. | 12. One-half tamarack and one-half spruce. |
| 1. Spruce. | 13. Noble fir. |
| 2. Western hemlock. | 14. Alpine fir. |
| 3. Sitka spruce. | 15. White spruce. |
| 4. Montana lodgepole pine. | 16. Engelmann spruce (Colorado). |
| 5. Western yellow pine. | 17. Amabilis fir. |
| 6. Balsam fir. | |

As the former group of tests has been previously reported upon (Forest Service Bulletin, "Experiments with Jack Pine and Hemlock for Mechanical Pulp"), only the last 17 papers manufactured at the Nekoosa-Edwards Paper Co. will be considered.

Table 57 gives the results of the commercial runs. Samples of the printed and unprinted sheets accompany this bulletin.

For the first 12 runs the same furnish of ground wood and sulphite to the beater was used in each case, the pulp consisting of quick-cook hemlock sulphite 25 per cent and experimental ground wood 75 per cent. In the last five tests the pulp was made up of 20 per cent of

FIG. 43.—White birch (*Betula papyrifera*).

quick-cook sulphite and 80 per cent of ground wood. The complete list of material furnished the beaters is given in Table 2.

The quantities of the different colors added varied with the color of the pulp. In every case attempt was made to duplicate the standard news color used by the company manufacturing the paper. It is very probable that if the sheets had been left uncolored, or had



FIG. 44.—Black gum (*Nyssa sylvatica*).

been colored a cream white, they would have presented a better appearance than they did.

Of the first series of 12 tests, those on white spruce, balsam fir, and Sitka spruce were run on a Fourdrinier paper machine trimming 109 inches wide and having a jacketed upper couch roll. On account of the slowness of the stock and insufficient suction the operation of the pulps in these three tests was somewhat unsatisfactory. There was sticking of the pulp to the couch and difficulty in securing good formation.

TABLE 2.—*Furnish to beater on basis of 1,000 pounds of paper. Commercial tests on experimental pulps.*

| Stock No. | Kind of ground wood. | Weight. | Sulphite. | Size. | Alum. | Soluble blue HA. | Rhodamine B extra. |
|-----------|----------------------------------|------------------|----------------|----------------|----------------|------------------|--------------------|
| | | <i>Pounds.</i> | <i>Pounds.</i> | <i>Pounds.</i> | <i>Pounds.</i> | <i>Ounces.</i> | <i>Ounces.</i> |
| 1 | Spruce..... | 750 | 250 | 3.33 | 6.67 | 3.2 | 0.167 |
| 2 | Western hemlock..... | 750 | 250 | 3.33 | 6.67 | 4.27 | .10 |
| 3 | Sitka spruce..... | 750 | 250 | 3.33 | 6.67 | 3.37 | .167 |
| 4 | Lodgepole pine (Montana)..... | 750 | 250 | 3.33 | 6.67 | 3.33 | .20 |
| 5 | Western yellow pine..... | 750 | 250 | 3.33 | 6.67 | 4.27 | .267 |
| 6 | Balsam fir..... | 750 | 250 | 3.33 | 6.67 | 2.53 | .167 |
| 7 | Lodgepole pine (California)..... | 750 | 250 | 3.33 | 6.67 | 3.2 | .167 |
| 8 | Red fir..... | 750 | 250 | 3.33 | 6.67 | 3.73 | .133 |
| 9 | Hemlock and spruce..... | ¹ 750 | 250 | 3.33 | 6.67 | 3.73 | .20 |
| 10 | Balsam and spruce..... | ¹ 750 | 250 | 3.33 | 6.67 | 2.6 | .167 |
| 11 | Tamarack..... | 750 | 250 | 3.33 | 6.67 | 5.33 | .667 |
| 12 | Tamarack and spruce..... | ¹ 750 | 250 | 3.33 | 6.67 | 4.00 | .4 |
| 13 | Noble fir..... | 800 | 200 | 3.33 | 10.0 | 5.4 | .40 |
| 14 | Alpine fir..... | 800 | 200 | 3.33 | 10.0 | 4.4 | .40 |
| 15 | White fir..... | 800 | 200 | 3.33 | 10.0 | 6.8 | .30 |
| 16 | Engelmann spruce (Colorado)..... | 800 | 200 | 3.33 | 10.0 | 4.8 | .375 |
| 17 | Amabilis fir..... | 800 | 200 | 3.33 | 10.0 | 5.0 | .400 |

¹375 pounds each.

The remainder of the 12 tests were run on a Fourdrinier machine trimming 100 inches and provided with a suction couch roll. The operation of pulp on this machine was much more satisfactory than on the other, although slowness of the stock made it impossible to use the dandy and a good formation could not be secured. Both of the paper machines ran at a speed of 460 feet per minute, and the screen plates were cut with slots 0.011 inch wide. In calendering the paper, 9 nips of a 12-roll calender stack were used.

So far as appearance and strength went, all the sheets manufactured at this time were considered very creditable. The No. 9 paper, containing 37½ per cent of hemlock ground wood, 37½ per cent of spruce ground wood, and 25 per cent of quick-cook hemlock sulphite, had a very high strength and took an excellent finish, though the color was slightly off. Both of the balsam sheets—No. 6 and No. 10—were very good both in strength and color. The western yellow-pine sheet ran very foamy and showed a number of scum spots, due largely to the pitch. Sheets of better formation undoubtedly could have been made if the pulp had been ground in a way to make it somewhat more “free.” The jordan machine was not used except to brush out the sulphite.

For the last 5 of the 17 commercial runs it was necessary to return to the first paper machine. In this series the paper was run at a speed of 450 feet per minute and passed through 11 nips of a 12-roll calender stack. All of the stocks were somewhat slow, but not so slow as were those of the previous series. The formation of the sheets, however, left much to be desired. Engelmann spruce (stock 16) and Alpine fir (stock 14) operated very satisfactorily with the dandy in use, but the stock from amabilis fir (stock 17) was very slow and sticky, and the dandy was removed for noble fir (stock 13) and white fir (stock

15). In this series the jordan in every case brushed as close as, or closer than, when the regular mill stock was being used.

The ground wood from Alpine fir and Engelmann spruce gave the best results from the standpoint of operation on the paper machine. All of the sheets in this series exhibited very good strength, while the color of those from Alpine fir, amabilis fir, and Engelmann spruce compared favorably with that of the spruce standard. So far as the paper-making qualities of the pulps are concerned, the 17 tests demonstrate that all of the woods used are satisfactory for news-print paper. It was suggested by the men operating the paper machines that even more satisfactory results could have been secured had a lighter sheet been run, such as is used for catalogues. Table 58 summarizes the results of strength and color tests on the papers manufactured from the commercial pulp samples. If the results of the single trial to obtain a good color for each experimental sheet are compared with the color ratings given in Table 3 for a few actual trade news-print sheets, it will be seen that the latter vary almost as widely in color as the experimental papers.

TABLE 3.—*Color ratings of commercial news-print sheets.*

| | Red. | Green. | Blue. | Black. | | Red. | Green. | Blue. | Black. |
|--------|------|--------|-------|--------|--------|------|--------|-------|--------|
| A..... | 61 | 59 | 54 | 126 | K..... | 66 | 61 | 59 | 114 |
| B..... | 61 | 57 | 50 | 132 | L..... | 68 | 60 | 58 | 114 |
| C..... | 66 | 62 | 59 | 112 | M..... | 71 | 61 | 59 | 109 |
| D..... | 61 | 59 | 54 | 126 | N..... | 58 | 56 | 56 | 130 |
| E..... | 69 | 65 | 60 | 106 | O..... | 65 | 58 | 57 | 120 |
| F..... | 70 | 66 | 54 | 110 | P..... | 56 | 55 | 55 | 134 |
| G..... | 61 | 59 | 54 | 126 | Q..... | 61 | 59 | 58 | 122 |
| H..... | 69 | 61 | 59 | 111 | R..... | 69 | 57 | 57 | 117 |
| I..... | 60 | 54 | 54 | 132 | S..... | 64 | 54 | 54 | 120 |
| J..... | 65 | 59 | 59 | 116 | | | | | |

TESTS ON NEWSPAPER PRESSES.

The final test of news-print paper is, of course, its behavior on the presses and the way it takes ink. Defects which are not apparent when the material is run over the machine become very evident when the paper is run through a high-speed press. Under such conditions, holes, calender cuts, and the like cause the paper to break.

The first 12 experimental papers were tested on the presses of the St. Louis Republic, St. Louis, Mo. They were run on two duplicate machines of the Hoe sextuple rotary type. Some of the rolls of experimental paper were 67 inches wide, others were 50½ inches, and still others 33½ inches wide. One entire city edition and a portion of another were printed on the experimental papers.

On one press the papers were run at the rate of 369 copies per minute, and on the other at the rate of 372 per minute, or 22,150 and 22,300 copies per hour, respectively. This corresponds to a speed of paper through the press of approximately 760 feet per minute.

Allowing for breaks and other interruptions, the actual number of papers printed per hour under ordinary conditions ranges from 10,000 to 19,000, depending on the quality of the paper used. In the case of the experimental papers none of the ordinary conditions of operation in the pressroom were changed in any particular. A single speed was maintained throughout the tests and the only adjustments made were those necessary to secure a good-looking sheet, such as changing the supply of ink to various portions of the type and adjusting the tension on the paper. Under ordinary conditions of operation in the pressroom of the St. Louis Republic there is one break to each ton (2,000 pounds) of paper run through the press. With the paper ordinarily used, 1,000 eight-page papers weigh 113 pounds. This corresponds to a sheet weighing approximately 31 pounds per ream of 500 sheets, 24 by 36 inches in size.

From Table 4, which gives the results of the printing tests, it will be seen that in some of the rolls, particularly those of white and Sitka spruce, there were a great many breaks. Almost all of these were due, however, to calender cuts on the edges of the sheets, scum spots, defective mill pasters, and poor winding. In the main, they were the result of inability to secure the best operating conditions on the paper machine before the supply of experimental pulp became exhausted. Difficulty with the spruces led us to believe that with proper operation on the machine practically all the trouble could have been eliminated.

TABLE 4.—*Printing-press data—experimental papers.*

ST. LOUIS REPUBLIC, APR. 29-30, 1913—67-INCH ROLLS.

| Stock No. | Weight at mill. | Tare. ¹ | Loss in transit. | Weight of wrapper. | Weight of paper at press. | Number of 8-page papers produced. ² | Weight per 1,000 8-page papers. | Weight per 500 24 by 36 inch sheets. | Number of breaks. | Remarks. |
|-----------|-----------------|--------------------|------------------|--------------------|---------------------------|--|---------------------------------|--------------------------------------|-------------------|--|
| | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | | Lbs. | Lbs. | | |
| 6 | 1,015 | 50 | 12 | 13.5 | 939.5 | 8,950 | 104.97 | 28.64 | ----- | Run good. |
| 10 | 1,478 | 44 | 17 | 20.0 | 1,397 | 13,020 | 107.29 | 29.24 | 5 | Breaks due to bad winding. |
| 4 | 1,494 | 60 | 23 | 25.0 | 1,386 | 12,660 | 109.47 | 29.85 | 8 | Breaks due to calender cut (and holes). |
| 2 | 1,567 | 53 | 16 | 18.0 | 1,480 | 13,710 | 107.95 | 29.41 | ----- | Run good. |
| 8 | 1,513 | 44 | ----- | 20.0 | 1,449 | 11,890 | 121.86 | 33.22 | ----- | Do. |
| 7 | 1,516 | 43 | 16 | 18.0 | 1,439 | 12,030 | 119.61 | 32.61 | ----- | Do. |
| 5 | 1,425 | 56 | 21 | 22.0 | 1,326 | 11,850 | 111.89 | 30.49 | 6 | Breaks due to calender cuts. |
| 11 | 1,321 | 41 | 82 | 19.0 | 1,179 | 10,220 | 115.36 | 31.44 | 3 | Breaks due to calender cuts (and holes). |
| 12 | 1,473 | 44 | 11 | 19.5 | 1,398.5 | 11,370 | 123.00 | 33.56 | 1 | Unknown (cuts on end of roll). |

ST. LOUIS REPUBLIC, APR. 29-30, 1913—50½-INCH ROLLS.

| | | | | | | | | | | |
|---|-------|----|-------|------|-------|--------|--------|-------|-------|---|
| 1 | 1,046 | 44 | 10 | 12.0 | 980 | 11,600 | 112.64 | 30.71 | 8 | Breaks due to bad winding. |
| 1 | 1,191 | 33 | ----- | 6.0 | 1,152 | 13,580 | 113.10 | 30.84 | 3 | 2 breaks from scum spots, 1 from mill paster. |
| 3 | 927 | 32 | 25 | 7.0 | 863 | 9,920 | 115.99 | 31.62 | 14 | 11 due to calender cuts, 3 to bad winding. |
| 3 | 873 | 45 | 6 | 7.0 | 815 | 9,400 | 115.60 | 31.53 | 3 | Due to calender cut and mill paster, cuts, and holes. |
| 9 | 1,134 | 31 | ----- | 15.0 | 1,088 | 12,270 | 118.22 | 32.22 | 4 | Do. |
| 9 | 1,027 | 32 | ----- | 9.0 | 986 | 11,020 | 119.29 | 32.52 | ----- | Run good. |

TABLE 4—*Printing-press data—experimental papers—Continued.*

ST. LOUIS REPUBLIC, APR. 29-30, 1913—33½-INCH ROLLS.

| Stock No. | Weight at mill. | Tare, ¹ | Less in transit. | Weight of wrapper. | Weight of paper at press. | Number of 8-page papers produced. | Weight per 1,000 8-page papers. | Weight per 500 24 by 36 inch sheets. | Number of breaks. | Remarks. |
|-----------|-----------------|--------------------|------------------|--------------------|---------------------------|-----------------------------------|---------------------------------|--------------------------------------|-------------------|------------------------|
| Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | | Lbs. | Lbs. | | |
| 6 | 464 | 22 | 9 | 12.0 | 421 | 8,590 | 98.02 | 26.74 | 1 | Run good; mill paster. |

NEW YORK HERALD, FEB. 14, 1914—66-INCH ROLLS.

| | | | | | | | | | | |
|----|-------|-----|-----|------|-------|--------|--------|------|-------|--------------------------------------|
| 13 | 1,386 | 145 | 72 | 19.0 | 1,241 | 12,170 | 101.96 | 30.0 | ..... | Run fair; breaks due to bad winding. |
| 14 | 1,361 | 97 | 44 | 19.0 | 1,245 | 11,422 | 109.00 | 31.5 | ..... | Run good. |
| 15 | 1,346 | 340 | 280 | 19.0 | 987 | 9,055 | 109.00 | 31.5 | ..... | Do. |
| 16 | 1,224 | 103 | 50 | 19.0 | 1,102 | 9,325 | 118.18 | 34.0 | ..... | Run fair. |
| 17 | 1,181 | 80 | 40 | 19.0 | 1,082 | 9,155 | 118.18 | 34.0 | ..... | Run good. |

¹ Figures for New York Herald run include waste and core.³ 150 spoils.² No data on number of spoils taken at St. Louis.⁴ 100 spoils.

So far as inking qualities and finish were concerned, the experimental papers were entirely satisfactory. Many of the sheets, however, had a muddy appearance, particularly when placed beside the light-colored all-spruce sheet. It was the opinion of the pressmen that, notwithstanding this, most of the sheets were very fair. Those which seemed most promising were the balsam sheet (stock 6,) which ran very satisfactorily, though light in weight, and in color compared favorably with the all-spruce sheet, and stock 9, containing 37½ per cent of hemlock ground wood and 37½ per cent of spruce ground wood, which compared very favorably in color and printing qualities with ordinary news-print paper. Both of the lodgepole sheets and the red-fir sheet also had a good color. The tamarack sheets (stocks 11 and 12) ran well, but were dark. The following is an extract from the St. Louis Republic regarding the trial runs of the experimental papers.

The paper was used to print a part of the issue of the Republic on both Tuesday, April 29, and Wednesday, April 30, these trial runs being the first and only efforts so far made to use the experimental paper in a commercial way. The Republic volunteered to cooperate with the Government laboratory, and is gratified that it can report the paper used was of a quality to justify hopeful anticipation that substitute woods can be used which will serve to hold a good part of the paper-making industry on American soil. * * *

RESULTS ENCOURAGING.

As already remarked, the experimental runs developed results that were quite distinctly encouraging. These, however, can not be appraised with any measure of exactness for several reasons. First of these was the fact that there was not enough of any one particular make of paper to enable the pressmen in charge of the Republic's presses to acquire the familiarity that tends to good results. Sixteen rolls were sent for trial, and in only three instances were there as many as two rolls of the same par-

ticular composition. To make this handicap greater, it was necessary to constantly run two rolls of wholly different component materials at the same time, so that the press data was inevitably mixed and breaks in the running couldn't be traced with the same satisfactory certainty that would have followed if only one kind of a paper at a time had been running on a press. The weight of the paper was also extremely variable, and tension set for a roll running heavy would, of course, have to be set differently for another roll running much lighter in weight. Despite these handicaps the demonstration was notably satisfactory in respect to running strength in more than one instance.

The conventional standard of the paper mills, in the matter of weight, is 32 pounds for 500 sheets measuring 24 by 36 in size, yet one roll of the experimental paper, which weighed only 26.74 pounds, had but one break. This particular paper was made from balsam fir and was of unmistakably good quality apart from its quite surprising strength. Another roll of the same composition ran without a single break, and the trials apparently gave conclusive proof that balsam fir is good paper-making material. The red-fir paper also showed good results, but the weight being 33.22 pounds, the demonstration was not quite so conclusive.

SUCCESS WITH NEW MATERIALS.

Taking all factors into consideration, strength, color, and finish, the paper made from balsam and spruce ground wood in equal proportions, roll No. 10, stock number, was the most completely satisfactory. This paper weighed only 29.24 pounds, and the five breaks that occurred in running it were attributed entirely to improper winding. The paper made from white spruce ground wood showed unexpected lack of strength, speaking relatively, but, as might be assumed, was comparatively good in color. The matter of color is the point on which the most serious criticism can be made, but there is good reason for believing that this fault can be remedied. Consumers of paper always count on more or less difficulty at the start in getting the color established at a satisfactory standard, so this experimental paper can not be fairly condemned on that ground.

But one kind of chemical pulp was used in the manufacture of these rolls, as the list already given indicates. It was hemlock sulphite in every instance. One roll, stock No. 2, was made entirely from hemlock, both ground wood and chemical pulp. This paper was somewhat dark, but it showed good strength. The press report shows five breaks, but they are attributed to winding rather than to the weakness of the paper notwithstanding it averaged only 29.24 pounds. Paper manufacturers have used hemlock pulp for years to more or less extent, but usually mixed with spruce, and it has never been ranked in the same class as spruce in the matter of quality. Ground wood made from hemlock has a tendency to develop unfelted fiber that stands up like whiskers on the surface of the paper, but the paper made from the Wausau laboratory pulp was notably free from this particular bad quality.

The last five experimental paper stocks were tested on the presses of the New York Herald, New York City. A 66-inch roll of each paper, weighing approximately 1,200 pounds, was used. This amount was sufficient for only a part of one city edition. It was impossible, moreover, to run each stock over the same press, and the five rolls were divided among three Goss sextuple presses. In all cases the sheet was printed at the rate of 400 eight-page papers per minute, or 24,000 per hour, equal to a speed through the press of 760 linear feet per minute. As in the case of the tests at St. Louis, the pressmen did not depart from their ordinary practice except for slight adjustment of tension upon the sheet and impression

of the type required by the particular stock being printed. During shipment to New York the roll made from white fir (stock 15) and that from amabilis fir (stock 17) were considerably battered and torn at the edges. This caused the rolls to run unevenly at the start, though after a short time no trouble was experienced.

The paper from Alpine fir (stock 14) gave a good, clean, white sheet, had a good surface, took ink well, and from the printer's standpoint was considered the best sheet of the series. The amabilis fir paper (stock 17), although not as well formed, had a good surface, brought out the cuts fairly well, and was ranked second in the series. In general, the papers fed smoothly and the few irregularities met with were due to defects which could be easily prevented after a little experience in manufacture.

Following is an extract from the New York Herald in regard to the tests:

WORKS WELL ON PRESSES.

When the paper was all run off the foreman said he had had no more difficulty with the experimental Government paper than with any other that ever had been used on the presses. It fed smoothly, and while a slight imperfection appeared here and there, this was attributed to the mechanical irregularities and not to a fault of the pulp stock. The amabilis fir and the Alpine fir were credited with being the best, having a better finish, better surface, better color, and with a much better formation. * * *

The experimental runs developed results that showed that the Government paper was being printed under a handicap. In the first place, there was not enough of any one particular sample of the paper to enable the pressmen to acquire the familiarity that tends to the most perfect results.

With all the paper different in texture, thickness, weight, and formation, it was necessary to run rolls of differing texture together, so that the press data naturally were constantly mixed and the few breaks in the running could not be traced with the same satisfactory certainty that is the case when one kind of paper is feeding through all the parts of the press. The weight of the paper was also variable, compared one roll with another, and the tension set for a roll running heavy would, of course, have to be set differently for another roll running much lighter in weight.

DEMONSTRATION SATISFACTORY.

Another handicap under which the Government experts worked lay in the fact that they had made up such a small quantity of the paper that they naturally did not have as fine a quality as if they had been able to experiment with a dozen rolls before they finally adjusted their machines to the ultimate product. Moreover, in its shipment it had been damaged, so that it rolled unevenly. Despite these handicaps the demonstration was notably satisfactory.

The general impression of the press experts was that the amabilis fir and the Alpine fir had given the best results in the press. These rolls had a blue-white surface and general softness that made it almost impossible to distinguish them from spruce papers.

To obtain the opinions of paper producers and users, samples of the experimental sheets were submitted to a number of manufacturers and publishers. Their comments tend to show that different sheets are favored by different individuals, a fact which

would seem to indicate that almost every sheet is satisfactory to some critic. Some of the comments are as follows:

Some of the papers, especially Nos. 3 and 6, have beautiful color, but none of the samples are any darker than paper I have seen printed commercially, made from spruce ground wood and hemlock sulphite pulp. * * *

Personally I like the appearance of sheets Nos. 6, 9, and 10. Of these, I think sheet No. 9 shows up very well. I can not see why any one of these sheets could not be used for printing newspapers.

I find considerable variation in color when the samples are placed next to each other, but I do not think that the variation is so great that the reader's attention will be called to the color of the paper in any instance. In fact, I have seen many newspapers printed on paper made entirely from spruce wood which did not look nearly so well as the poorest of the samples submitted by you.

All of these samples on the last run seemed to show up very well indeed, and any one of them ought to serve for newspaper purposes.

PROBLEMS IN CONNECTION WITH THE EXPERIMENTAL WOODS.

Some of the woods tested are resinous, which makes them unsuitable for the manufacture of paper on a high-speed machine. There should be some inexpensive way of treating the resinous woods which would not darken them. It is possible that such treatment would have to be given in the beater. At the same time tests should be made on resinous woods at different times of the year, since it is likely that the time of cutting has a material influence on the operation of the pulp on the paper machine.

The color of many of the woods could probably be bettered by a suitable bleaching treatment while the pulp was being manufactured into laps or while the latter were being stored. Experiments might also be made to ascertain whether the sheets which are only slightly off color could not be brought up to the standard of white required for news-print purposes by the addition of dyes.

A problem not directly connected with pulp and paper production, but of importance to it, is that brought about by the decay of the wood when piled at the mill and of the pulp during storage. Some of the experimental woods decay rapidly and are subject to attacks of insects and fungi. Some reasonably cheap method of insuring these woods against decay and insects will have to be found if they are to be used in any quantity.

METHODS OF INCREASING THE EFFICIENCY OF GRINDING.

There are in the United States approximately 1,500 wood-pulp grinders of different sizes, each of which utilizes on the average 350 horsepower continuously. The amount of power applied to grinders has been increasing steadily from year to year. Where in the beginning of the mechanical pulp industry 125 horsepower was used on the grinder, in many cases now 600 to 750 horsepower is employed, and in the case of the automatic magazine grinder from 1,000 to 1,200 horsepower is utilized. Of the total number of grinders in the United States upon which information is available 36 per cent

are driven by turbines and motors of less than 300 horsepower capacity and 8 per cent of the grinders are driven by less than 200 horsepower. The work which has been described in this publication indicates that a large amount of power to the grinder is desirable. In order to utilize a large amount of power, the stones must be operated under conditions of high speed and high pressure, or they must be of a larger size than those used at the present time. Efficiency of grinding wood can be greatly increased over present average commercial practice by the use of higher pressure, since this results in the reduction of the horsepower consumption per ton of product. There are cases, of course, where such practice would not be desirable. If sulphite is available at low cost and power is expensive, this condition would surely obtain; but if sulphite is expensive and power can be secured at a low figure it is undoubtedly more economical to use a large amount of power per ton of product and make economies in sulphite by virtue of the fact that with the large amount of power better and stronger ground-wood fiber can be obtained.

Economies in grinding, particularly as related to power, depend largely on the character of the material into which the ground wood is to be incorporated. For the manufacturing of such materials as wood-pulp board, as used in the wall-board industry, a long, coarse fiber is required, and this is most desirable, since fibers of this nature do not form as dense a sheet. There are, as a result, a large number of air spaces present which retard the passage of cold and sound. For the production of pulp of this nature pulp stones of coarse grit are required which are softer than those usually employed for the manufacturing of pulps for other purposes. When using a coarse stone, a longer fiber can be obtained at higher pressure than when a finer stone is utilized. Consequently, it is desirable in the production of this character of stock to choose the pulp stone carefully to secure the best results. The matter of efficiency as applied to the manufacturing of stock for any desired purpose hinges, to a large measure, on a careful selection of the pulp stone to be used.

It is common practice in ground-wood mills to use all of the pockets on the grinder in the production of the mechanical pulp. In other words, the total amount of power available for use on the grinder is used on all of the pockets and at the same time. Power can be saved and the efficiency of production increased to a marked extent by the utilization of a fewer than the total number of pockets of the grinder. If four-pocket grinders are used, it is more desirable to use three of the pockets continuously and keep the fourth for surplus to be employed at times when one of the other pockets is being filled or when binding or other troubles are being corrected. When all of the power available on a three-pocket grinder is used

on three pockets, due to the need of filling and frequent binding of the wood in the cells, the total power is used about 88 per cent of the time. In other words, only 88 per cent of the power is being used continuously. When two pockets on the same three-pocket grinder are used to consume the total power and the third is kept for surplus, as previously outlined, all of the power is in use approximately 93 to 95 per cent of the time. Here a saving can be made and the efficiency increased without the installation or use of any additional apparatus, simply by means of increasing the pressure on the grinder cylinders, since this would be necessary if all of the power were applied to two instead of the three pockets on that piece of apparatus. Of course, this does not have as great bearing on the increasing of efficiency when grinders are motor driven; but in case of the direct connection to turbines it will be seen that it is of great consequence.

When grinders are motor driven, the most efficient utilization of the power can be accomplished by the installation of a grinder-cylinder pressure-regulating valve controlled electrically from the bus bars, the idea being to increase the pressure when for any reason the power consumption falls off.

Not only does the increasing of pressure on the cylinders result in the lowering of the horsepower consumption per ton, but there is at higher pressures an increase in the quantity of pulp which can be secured from a cord of wood, and this is another vital factor in the study of the efficiency of production of mechanical pulp. In any case it seems desirable to study carefully the grinding conditions, the speed of the pulp stone, the pressure employed, and the character and grit of the stone in use, since it is to these factors that practically all losses and gains can be traced. The manipulation of the grinder and its feeding and operation by the grinderman are also of prime importance, since without careful watching the binding of the wood in the pockets or some like difficulty may result in reduction of the production from the grinder and also in the lowering on quality of the resultant product. Even with careful watching there are times while the grinder is apparently running satisfactorily when hardly three-fourths of the total power available for its use is being consumed, due to the binding of the wood in the pockets.

FUTURE SUPPLIES FOR THE GROUND-WOOD INDUSTRY.

Of the woods tested, Alpine fir, Engelmann spruce, lowland fir, lodgepole pine, balsam fir, white fir, amabilis fir, noble fir, Sitka spruce, western hemlock, and eastern hemlock all give promise of being suitable for the production of news-print papers. Color is here the chief consideration. An acceptable news-print paper can not be made from such a dark-colored pulp as that of tamarack. Yet this does not bar tamarack as a raw material for the ground-wood industry; it will give a thoroughly satisfactory grade of yellow manila.

Similarly, jack pine, which is also unsatisfactory for news-print purposes, can be used very effectively in the manufacture of box boards. When combined with a large proportion of sulphite any of the woods tested, except the hardwoods, should produce a satisfactory manila of a color other than white. For the manufacture of wood-pulp boards, jack pine, tamarack, loblolly pine, and larch, in addition to the woods mentioned as suitable for news print, should furnish acceptable material. When high color is desired, and a somewhat poorer one in the center of the board is not objectionable, black gum or poplar could be used as a liner, if combined with a small percentage of sulphite. In the manufacture of box boards from steamed wood all of the conifers tested could be utilized, except where the product was to be a strong container board. The spruces, however, will yield a steamed pulp suitable for almost every kind of container.

It will be noted that the great majority of the substitute woods are confined to the West, while the ground-wood industry at present obtains the bulk of its supply of raw material from the East. The industry, however, is really a frontier one. It must have a plentiful supply of wood and an abundance of cheap power, two things not readily obtainable in settled communities. As the regions in which the industry is now centered develop it will have to move on to other and less-settled ones. On the National Forests are immense quantities of many of the woods tested and abundant opportunities for power development.

APPENDIX A.

List of tables contained in Appendix A.

| Species. | Grinding data. | Page. | Quality test data. | Page. |
|-----------------------------------|------------------|-------|--------------------|-------|
| White spruce: | <i>Table No.</i> | | <i>Table No.</i> | |
| Untreated..... | 5 | 68 | 7 | 78 |
| Cooked..... | 6 | 74 | | |
| Balsam fir..... | 8 | 86 | 33 | 124 |
| Red fir..... | 9 | 88 | 34 | 125 |
| White fir..... | 10 | 90 | 35 | 126 |
| Alpine fir..... | 11 | 92 | 36 | 127 |
| Amabilis fir..... | 12 | 93 | 37 | 128 |
| Lowland fir..... | 13 | 94 | 38 | 129 |
| Noble fir..... | 14 | 95 | 39 | 130 |
| Hemlock..... | 15 | 96 | 40 | 131 |
| Western hemlock..... | 16 | 98 | 41 | 131 |
| Tamarack..... | 17 | 99 | 42 | 132 |
| Western larch..... | 18 | 103 | 43 | 134 |
| Lodgepole pine: | | | | |
| Montana..... | 19 | 104 | 44 | 135 |
| California..... | 20 | 106 | 45 | 136 |
| Western yellow pine..... | 21 | 108 | 46 | 137 |
| Jack pine..... | 22 | 110 | 47 | 138 |
| Loblolly pine..... | 23 | 112 | 48 | 139 |
| White pine..... | 24 | 114 | 49 | 140 |
| Engelmann spruce: | | | | |
| Montana..... | 25 | 115 | 50 | 141 |
| Colorado..... | 26 | 116 | 51 | 142 |
| Sitka spruce..... | 27 | 117 | 52 | 143 |
| White birch..... | 28 | 118 | 53 | 144 |
| Aspen..... | 29 | 119 | 54 | 144 |
| Black gum..... | 30 | 120 | 55 | 145 |
| Mixtures of wood..... | 31 | 121 | 56 | 146 |
| Woods for "commercial pulps"..... | 57 | 148 | 58 | 150 |

TABLE 5.—Grinder runs on white spruce.

| Run No. | Stone. | Kind of burr. | Surface. | Number of pockets used. | Pressure on 14-inch cylinder. | Pressure per square inch of pocket area. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton bone-dry pulp in 24 hours. | Solid rossed wood ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | Bone-dry pulp per 100 cubic feet solid rossed wood. | Efficiency of conversion. | Screens per 100 cubic feet solid rossed wood. | Average temperature of grinding. | Horsepower divided by pressure \times speed. |
|---------|--------|--|---------------|-------------------------|-------------------------------|--|-------------------------|-------------------|--------------------------------|--------------------------------|----------------------------|---|---------------------------------------|--------------------------------------|---------------------------|-------------------|---|---------------------------|---|----------------------------------|--|
| | | | | Lbs. per sq. in. | Lbs. | Lbs. | Feet per minute. | Feet per minute. | Average horsepower to grinder. | Maximum horsepower to grinder. | Tons. | Horsepower per ton bone-dry pulp in 24 hours. | Cu. ft. | Lbs. | In. | Per cent. | Lbs. | Per cent. | Lbs. | ° F. | |
| 1 | | Straight, cut 3 to inch; spiral, cut 12 to inch. | Stone dressed | 3 40; 50 | 16.4 | 16.4 | 175 | 2,445 | 403.0 | | 4.988 | 80.8 | | | | | | | | | |
| 11 | | do. | Same surface. | 3 40; 50 | 16.4 | 16.4 | 175 | 2,445 | 399.0 | | 4.525 | 88.1 | | | | | | | | | |
| | | Total | | | | | | | | | | | | | | | | | | | |
| | | Weighted averages | | | | | | | | | | | | | | | | | | | |
| 2 | | Straight, cut 3 to inch; spiral, cut 12 to inch. | Stone dressed | 3 40 | 16.4 | 16.4 | 200 | 2,795 | 398.0 | | 4.245 | 83.8 | | | | | | | | | |
| 12 | | do. | Same surface. | 3 40 | 16.4 | 16.4 | 200 | 2,795 | 408.0 | | 3.995 | 102.0 | | | | | | | | | |
| 12 | | do. | do. | 3 40 | 16.4 | 16.4 | 200 | 2,795 | 394.0 | | 4.175 | 94.4 | | | | | | | | | |
| | | Total | | | | | | | | | | | | | | | | | | | |
| | | Weighted averages | | | | | | | | | | | | | | | | | | | |
| 13 | | Straight, cut 3 to inch; spiral, cut 12 to inch. | Stone dressed | 3 20 | 8.2 | 8.2 | 175 | 2,445 | 191.0 | 215 | 1.215 | 157.0 | 105.4 | 27.66 | 30.14 | 2,300 | 83.2 | 9.82 | 163.0 | 166.5 | .00954 |
| 14 | | do. | Same surface. | 3 40 | 16.4 | 16.4 | 175 | 2,445 | 333.0 | 388 | 3.025 | 110.0 | 251.3 | 27.66 | 30.14 | 2,408 | 87.1 | 17.80 | 166.5 | 166.5 | .00830 |
| 15 | | do. | do. | 3 60 | 24.05 | 24.05 | 175 | 2,445 | 454.0 | 506 | 5.255 | 86.4 | 436.0 | 27.66 | 30.14 | 2,415 | 87.3 | 18.60 | 152.2 | 152.2 | .00753 |
| 16 | | do. | do. | 3 20 | 8.2 | 8.2 | 225 | 3,145 | 235.0 | 264 | 1.198 | 188.0 | 106.2 | 27.66 | 30.14 | 2,255 | 81.5 | 9.66 | 179.8 | 179.8 | .00873 |
| 17 | | do. | do. | 3 40 | 16.4 | 16.4 | 225 | 3,145 | 425.0 | 494 | 3.775 | 109.0 | 314.0 | 27.66 | 30.14 | 2,404 | 87.0 | 10.15 | 161.8 | 161.8 | .00799 |
| 18 | | do. | do. | 3 60 | 24.05 | 24.05 | 225 | 3,145 | 567.0 | 651 | 6.215 | 91.2 | 474.5 | 27.66 | 30.14 | 2,624 | 95.0 | 15.70 | 158.3 | 158.3 | .00731 |
| 19 | | Spiral, cut 6 to inch. | Stone dressed | 3 20 | 8.2 | 8.2 | 175 | 2,442 | 174.7 | 222 | .995 | 175.5 | 93.7 | 27.66 | 30.14 | 2,122 | 76.8 | 13.54 | 165.5 | 165.5 | .008715 |
| 110 | | do. | do. | 3 40 | 16.4 | 16.4 | 175 | 2,442 | 287.0 | 357 | 3.850 | 74.5 | 311.0 | 27.66 | 30.14 | 2,478 | 89.5 | 21.10 | 139.2 | 139.2 | .007155 |
| 111 | | do. | Same surface. | 3 60 | 24.05 | 24.05 | 175 | 2,442 | 397.0 | 480 | 6.090 | 65.5 | 505.0 | 27.66 | 30.14 | 2,400 | 86.8 | 56.50 | 142.2 | 142.2 | .00659 |
| 112 | | do. | do. | 3 20 | 8.2 | 8.2 | 225 | 3,140 | 235.0 | 280 | 2.995 | 75.2 | 216.6 | 27.66 | 30.14 | 2,302 | 83.3 | 19.57 | 154.0 | 154.0 | .00874 |
| 113 | | do. | do. | 3 40 | 16.4 | 16.4 | 225 | 3,140 | 356.0 | 431 | 5.305 | 67.2 | 431.0 | 27.66 | 29.04 | 2,464 | 88.7 | 16.75 | 137.0 | 137.0 | .00691 |

| | | | | | | | | | | | | | | | | | | | |
|-----|---------------------------|---|----|-------|-----|-------|-------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|---------|
| 114 | do. | 3 | 60 | 24.65 | 225 | 3,140 | 508.0 | 586 | 7.840 | 64.9 | 654.0 | 28.11 | 29.04 | 2,400 | 85.4 | 30.95 | 135.7 | 0.0556 | |
| 115 | do. | 3 | 20 | 8.2 | 175 | 2,442 | 178.5 | 212 | 1,910 | 93.5 | 166.4 | 27.52 | 29.29 | 2,298 | 83.9 | 12.60 | 144.2 | 0.0891 | |
| 116 | Stone dressed. | 3 | 20 | 8.2 | 175 | 2,442 | 183.0 | 210 | 1,435 | 121.6 | 126.3 | 27.52 | 28.29 | 2,390 | 83.5 | 11.05 | 160.3 | 0.0913 | |
| 117 | do. | 3 | 40 | 16.4 | 175 | 2,442 | 327.0 | 388 | 3,705 | 88.2 | 326.0 | 27.59 | 27.81 | 2,272 | 82.4 | 13.20 | 147.0 | 0.0815 | |
| 118 | do. | 3 | 60 | 24.65 | 175 | 2,442 | 426.0 | 489 | 5,340 | 79.8 | 455.0 | 27.59 | 27.81 | 2,345 | 85.0 | 9.84 | 141.0 | 0.0707 | |
| 119 | do. | 3 | 20 | 8.2 | 225 | 3,140 | 234.0 | 287 | 1,182 | 112.0 | 181.0 | 27.59 | 27.81 | 2,088 | 87.3 | 7.75 | 158.2 | 0.0909 | |
| 120 | do. | 3 | 40 | 16.4 | 225 | 3,140 | 379.0 | 441 | 4,220 | 88.0 | 359.0 | 27.59 | 27.81 | 2,350 | 85.2 | 12.60 | 151.8 | 0.0735 | |
| 121 | do. | 3 | 60 | 24.65 | 225 | 3,140 | 521.0 | 592 | 6,360 | 82.0 | 534.5 | 29.12 | 27.32 | 2,380 | 81.8 | 11.50 | 148.6 | 0.0735 | |
| 122 | do. | 3 | 40 | 16.4 | 175 | 2,442 | 312.0 | 378 | 2,155 | 144.8 | 200.0 | 27.80 | 33.8 | 27.42 | 2,155 | 77.5 | 7.45 | 170.8 | 0.0778 |
| 123 | Straight, cut 12 to inch. | 3 | 40 | 16.4 | 175 | 2,442 | 321.0 | 365 | 2,260 | 142.0 | 197.5 | 28.34 | 13 | 27.57 | 2,290 | 80.8 | 7.73 | 171.5 | 0.0800 |
| 124 | do. | 3 | 40 | 16.4 | 175 | 2,442 | 324.0 | 372 | 2,415 | 134.0 | 267.5 | 21.08 | 84 | 37.74 | 1,820 | 86.3 | 7.84 | 163.1 | 0.0808 |
| 125 | do. | 3 | 40 | 16.4 | 175 | 2,442 | 324.0 | 372 | 2,415 | 134.0 | 267.5 | 21.08 | 84 | 37.74 | 1,820 | 86.3 | 7.84 | 163.1 | 0.0808 |
| 126 | Stone dressed. | 3 | 60 | 24.65 | 100 | 1,398 | 293.0 | 359 | 3,655 | 99.5 | 255.0 | 27.00 | 53 | 31.70 | 2,360 | 85.5 | 12.90 | 140.2 | 0.0867 |
| 127 | do. | 3 | 50 | 24.65 | 150 | 2,093 | 416.0 | 478 | 4,005 | 88.0 | 382.0 | 29.05 | 53 | 27.90 | 2,440 | 84.0 | 20.00 | 149.5 | 0.0807 |
| 128 | do. | 3 | 60 | 24.65 | 200 | 2,792 | 529.0 | 635 | 5,960 | 88.7 | 481.6 | 29.05 | 53 | 27.90 | 2,476 | 85.1 | 20.06 | 149.3 | 0.0768 |
| 129 | do. | 3 | 60 | 24.65 | 250 | 3,496 | 640.0 | 701 | 7,850 | 81.5 | 675.0 | 27.00 | 5 | 28.40 | 2,326 | 86.0 | 11.00 | 138.6 | 0.0743 |
| 130 | do. | 3 | 40 | 12.36 | 250 | 3,490 | 350.0 | 397 | 2,938 | 119.2 | 251.5 | 28.68 | 5 | 30.40 | 2,390 | 81.5 | 8.54 | 163.2 | 0.0811 |
| 131 | do. | 3 | 40 | 16.4 | 188 | 2,624 | 355.0 | 428 | 2,950 | 120.3 | 247.0 | 28.68 | 5 | 30.40 | 2,390 | 81.5 | 8.54 | 163.2 | 0.0811 |
| 132 | do. | 3 | 50 | 20.5 | 130 | 2,093 | 336.0 | 391 | 3,860 | 92.5 | 318.0 | 26.88 | 5 | 31.00 | 2,340 | 90.0 | 9.94 | 146.3 | 0.0830 |
| 133 | do. | 3 | 60 | 24.65 | 125 | 1,745 | 348.0 | 407 | 3,580 | 100.7 | 306.0 | 26.88 | 5 | 31.00 | 2,340 | 90.0 | 9.94 | 146.3 | 0.0830 |
| 134 | do. | 3 | 40 | 16.4 | 188 | 2,624 | 343.0 | 408 | 2,685 | 127.7 | 336.2 | 27.24 | 5 | 28.30 | 2,275 | 83.5 | 10.27 | 172.9 | 0.0736 |
| 135 | do. | 3 | 40 | 16.4 | 188 | 2,624 | 343.0 | 408 | 2,685 | 127.7 | 336.2 | 27.24 | 5 | 28.30 | 2,275 | 83.5 | 10.27 | 172.9 | 0.0736 |
| 136 | Stone dressed. | 3 | 30 | 12.32 | 250 | 3,470 | 314.0 | 385 | 5,200 | 60.4 | 441.5 | 27.24 | 5 | 28.30 | 2,355 | 86.7 | 13.2 | 153.5 | 0.0806 |
| 137 | do. | 3 | 35 | 14.36 | 214 | 2,970 | 344.0 | 404 | 6,040 | 57.0 | 505.0 | 27.24 | 5 | 28.30 | 2,390 | 87.8 | 12.05 | 131.5 | 0.0736 |
| 138 | do. | 3 | 40 | 16.4 | 188 | 2,609 | 320.5 | 389 | 5,290 | 60.6 | 452.0 | 27.24 | 5 | 28.30 | 2,388 | 86.8 | 14.18 | 123.2 | 0.0749 |
| 139 | do. | 3 | 45 | 18.46 | 167 | 2,318 | 341.0 | 392 | 5,255 | 64.9 | 444.0 | 27.35 | 5 | 29.98 | 2,370 | 86.0 | 14.18 | 128.0 | 0.07975 |
| 140 | do. | 3 | 50 | 20.5 | 150 | 2,081 | 339.0 | 399 | 5,230 | 64.8 | 445.0 | 27.35 | 5 | 29.98 | 2,355 | 86.1 | 13.22 | 127.4 | 0.0795 |
| 141 | do. | 3 | 55 | 22.6 | 136 | 1,887 | 323.0 | 381 | 5,200 | 63.1 | 432.0 | 27.35 | 5 | 29.98 | 2,410 | 88.1 | 18.96 | 129.5 | 0.0770 |
| 142 | do. | 3 | 60 | 24.65 | 125 | 1,774 | 327.0 | 380 | 4,870 | 67.1 | 428.0 | 27.35 | 5 | 29.98 | 2,280 | 83.4 | 21.80 | 131.7 | 0.0765 |
| 143 | do. | 3 | 50 | 20.5 | 200 | 2,775 | 429.0 | 495 | 5,875 | 73.0 | 502.0 | 27.60 | 5 | 31.40 | 2,340 | 84.8 | 13.10 | 136.0 | 0.0754 |
| 144 | do. | 3 | 50 | 20.5 | 200 | 2,775 | 430.5 | 481 | 5,240 | 76.5 | 434.0 | 27.60 | 5 | 31.40 | 2,418 | 87.6 | 13.13 | 116.6 | 0.0704 |
| 145 | do. | 3 | 50 | 20.5 | 200 | 2,775 | 433.0 | 515 | 6,210 | 72.9 | 529.0 | 27.60 | 5 | 31.40 | 2,350 | 85.2 | 17.92 | 159.3 | 0.0797 |
| 146 | do. | 3 | 20 | 8.2 | 175 | 2,428 | 164.0 | 183 | 1,640 | 101.2 | 132.0 | 28.35 | 5 | 33.25 | 2,455 | 86.5 | 6.83 | 85.0 | 0.0824 |
| 147 | do. | 3 | 40 | 16.4 | 175 | 2,428 | 315.5 | 366 | 3,110 | 101.3 | 252.0 | 28.35 | 5 | 33.25 | 2,470 | 87.0 | 7.98 | 87.8 | 0.0792 |
| 148 | do. | 3 | 60 | 24.65 | 175 | 2,428 | 412.0 | 526 | 5,145 | 86.0 | 392.0 | 28.35 | 5 | 33.25 | 2,620 | 92.4 | 13.12 | 86.7 | 0.0739 |
| 149 | do. | 3 | 20 | 8.2 | 175 | 2,428 | 177.7 | 209 | 1,105 | 160.7 | 89.1 | 28.35 | 57 | 33.25 | 2,480 | 87.5 | 11.90 | 176.3 | 0.0892 |
| 150 | do. | 3 | 40 | 16.4 | 175 | 2,428 | 323.0 | 360 | 3,410 | 94.7 | 350.0 | 22.40 | 63 | 44.00 | 1,950 | 87.0 | 9.50 | 152.7 | 0.0778 |
| 151 | do. | 3 | 60 | 24.65 | 175 | 2,428 | 449.0 | 531 | 5,610 | 79.9 | 382.0 | 22.40 | 63 | 44.00 | 1,930 | 86.1 | 15.83 | 145.0 | 0.0719 |
| 152 | do. | 3 | 20 | 8.2 | 175 | 2,428 | 176.8 | 222 | 1,340 | 131.0 | 144.6 | 22.40 | 6 | 44.00 | 1,870 | 86.5 | 3.48 | 86.4 | 0.0888 |
| 153 | do. | 3 | 40 | 16.4 | 175 | 2,428 | 320.0 | 406 | 2,820 | 133.5 | 283.0 | 22.40 | 6 | 44.00 | 1,932 | 87.2 | 8.45 | 86.0 | 0.0726 |
| 154 | do. | 3 | 60 | 24.65 | 175 | 2,428 | 435.0 | 487 | 4,680 | 93.0 | 461.0 | 22.40 | 6 | 44.00 | 2,030 | 90.0 | 8.22 | 88.3 | 0.0726 |
| 155 | do. | 3 | 20 | 8.2 | 225 | 3,107 | 148.0 | 160 | 816 | 181.2 | 80.0 | 26.61 | 58 | 24.14 | 2,040 | 70.6 | 6.65 | 171.3 | 0.0581 |
| 156 | do. | 3 | 40 | 16.4 | 225 | 3,107 | 282.0 | 334 | 2,695 | 104.7 | 249.0 | 26.61 | 6 | 24.14 | 2,160 | 84.1 | 9.70 | 139.3 | 0.0533 |
| 157 | do. | 3 | 60 | 24.65 | 225 | 3,107 | 394.0 | 447 | 5,770 | 68.3 | 519.0 | 26.34 | 4 | 25.12 | 2,258 | 84.5 | 11.40 | 137.8 | 0.0514 |
| 158 | do. | 3 | 20 | 8.2 | 225 | 3,107 | 497.0 | 551 | 8,340 | 59.6 | 738.0 | 26.34 | 4 | 25.12 | 2,258 | 85.7 | 15.85 | 136.3 | 0.0487 |
| 159 | do. | 3 | 20 | 41.0 | 225 | 3,107 | 536.0 | 621 | 9,770 | 57.0 | 860.0 | 26.34 | 4 | 25.12 | 2,272 | 86.2 | 20.24 | 133.7 | 0.0436 |
| 160 | do. | 3 | 40 | 16.4 | 250 | 3,452 | 285.0 | 326 | 4,600 | 62.0 | 400.0 | 26.34 | 61 | 25.12 | 2,280 | 86.6 | 7.35 | 139.1 | 0.0504 |
| 161 | do. | 3 | 60 | 24.64 | 250 | 3,452 | 426.0 | 460 | 5,000 | 62.0 | 400.0 | 26.34 | 61 | 25.12 | 2,280 | 86.6 | 7.35 | 139.1 | 0.0500 |

Stone too sharp and pulp too short for test to be of any practical value; data discarded.

stone too sharp and pul-
value; data discarded.

1 Seasoned wood used.

TABLE 5.—Grinder runs on white spruce—Continued.

| Run No. | Kind of burr | Surface. | Number of pockets used. | Pressure on 14-inch cylinder. | Lbs. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton bone-dry pulp in 24 hours. | Solid rossed wood ground in 24 hours. | Weight dry wood. | Average diameter of wood. | Moisture in wood. | | Bone-dry pulp per 100 cubic feet solid rossed wood. | Efficiency of conversion. | Screenings per 100 cubic feet solid rossed wood. | Average temperature of bone-dry. | Average temperature of grinding. | Horsepower divided by pressure X speed. |
|---------|--|-------------------------|-------------------------|-------------------------------|-------|-------------------------|-------------------|--------------------------------|--------------------------------|----------------------------|---|---------------------------------------|------------------|---------------------------|-------------------|-------|---|---------------------------|--|----------------------------------|----------------------------------|---|
| | | | | | | | | | | | | | | | Per cent. | Lbs. | | | | | | |
| 100 | Straight, cut 3 to inch; spiral, cut 12 to inch. | Stone dressed | 3 | 40 | 16.4 | 100 | 1,381 | 194.0 | 242 | 2.110 | 92.0 | 271.0 | 25.03 | 5 | 25.31 | 2,220 | 81.9 | 9.43 | 141.5 | 0.00856 | | |
| 161 | do. | Same surface | 3 | 40 | 16.4 | 150 | 2,071 | 275.0 | 318 | 3.005 | 91.5 | 271.0 | 25.03 | 4 | 30.54 | 2,218 | 88.5 | 11.16 | 146.8 | .00810 | | |
| 162 | do. | do. | 3 | 40 | 16.4 | 200 | 2,762 | 354.0 | 427 | 4.080 | 86.7 | 358.0 | 25.03 | 5 | 30.54 | 2,280 | 91.0 | 8.50 | 143.9 | .00781 | | |
| 163 | do. | do. | 3 | 40 | 16.4 | 250 | 3,452 | 407.0 | 460 | 4.980 | 81.8 | 439.0 | 25.03 | 5 | 30.54 | 2,270 | 90.6 | 7.91 | 144.1 | .00780 | | |
| 164 | do. | do. | 3 | 60 | 24.65 | 100 | 1,381 | 275.0 | 322 | 3.500 | 78.6 | 303.0 | 25.72 | 5 | 28.83 | 2,310 | 88.9 | 18.27 | 141.1 | .00806 | | |
| 165 | do. | do. | 3 | 60 | 24.65 | 150 | 2,071 | 362.0 | 419 | 4.500 | 80.5 | 398.0 | 25.72 | 5 | 28.83 | 2,262 | 88.0 | 11.82 | 137.7 | .00709 | | |
| 166 | do. | do. | 3 | 60 | 24.65 | 200 | 2,762 | 481.0 | 560 | 5.800 | 83.0 | 505.0 | 25.72 | 5 | 28.83 | 2,298 | 88.0 | 12.32 | 143.0 | .00641 | | |
| 167 | do. | do. | 3 | 60 | 24.65 | 250 | 3,452 | 546.0 | 620 | 7.335 | 74.5 | 675.0 | 25.08 | 5 | 27.64 | 2,170 | 86.5 | 13.53 | 140.0 | .00536 | | |
| 168 | do. | do. | 2 | 60 | 16.4 | 250 | 3,452 | 301.0 | 350 | 3.715 | 81.8 | 336.0 | 25.88 | 6 | 27.34 | 2,210 | 85.4 | 7.22 | 144.8 | .00336 | | |
| 169 | do. | do. | 2 | 60 | 24.65 | 250 | 3,452 | 401.0 | 431 | 5.500 | 71.8 | 489.0 | 25.88 | 5 | 27.34 | 2,280 | 88.1 | 10.22 | 138.8 | .00471 | | |
| 170 | do. | do. | 2 | 80 | 32.8 | 250 | 3,452 | 510.0 | 564 | 8.100 | 63.0 | 700.0 | 26.15 | 5 | 28.40 | 2,285 | 88.1 | 13.26 | 134.6 | .00450 | | |
| 171 | do. | do. | 2 | 100 | 41.0 | 250 | 3,452 | 543.0 | 601 | 8.930 | 60.8 | 790.0 | 26.15 | 6 | 32.38 | 2,288 | 87.5 | 11.26 | 129.2 | .00450 | | |
| 274 | do. | Same as No. 73. | 3 | 60 | 8.2 | 175 | 2,417 | 437.0 | 502 | 5.025 | 89.9 | 492.0 | 27.09 | 6 | 39.70 | 2,042 | 75.9 | 9.90 | 145.4 | .00760 | | |
| 275 | do. | do. | 3 | 40 | 16.4 | 175 | 2,417 | 330.0 | 367 | 2.900 | 113.8 | 275.0 | 27.09 | 7 | 39.70 | 2,110 | 77.9 | 7.60 | 149.2 | .00833 | | |
| 276 | do. | do. | 3 | 20 | 24.65 | 175 | 2,417 | 183.0 | 239 | .987 | 188.0 | 98.5 | 27.09 | 6 | 39.70 | 2,004 | 74.1 | 5.67 | 174.1 | .00838 | | |
| 180 | do. | Same as No. 79. | 4 | 20 | 8.2 | 175 | 2,417 | 334.0 | 392 | 2.925 | 132.2 | 237.0 | 27.47 | 5 | 28.33 | 2,216 | 74.3 | 10.43 | 181.8 | .00925 | | |
| 181 | do. | do. | 4 | 20 | 16.4 | 175 | 2,417 | 449.0 | 527 | 4.500 | 97.8 | 413.0 | 27.47 | 5 | 28.33 | 2,220 | 80.8 | 15.07 | 148.0 | .00754 | | |
| 182 | do. | do. | 3 | 60 | 24.65 | 175 | 2,417 | 449.0 | 527 | 4.500 | 97.8 | 413.0 | 27.47 | 7 | 39.70 | 2,120 | 78.2 | 15.05 | 148.1 | .00824 | | |
| 283 | do. | do. | 3 | 60 | 24.65 | 100 | 1,381 | 281.0 | 323 | 3.590 | 117.2 | 269.0 | 27.09 | 7 | 37.56 | 2,284 | 84.4 | 20.5 | 155.8 | .00810 | | |
| 284 | do. | do. | 3 | 60 | 24.65 | 150 | 2,072 | 414.0 | 467 | 4.590 | 92.6 | 369.0 | 27.12 | 6 | 37.56 | 2,280 | 81.9 | 14.21 | 148.7 | .00796 | | |
| 285 | do. | do. | 3 | 60 | 24.65 | 200 | 2,762 | 495.0 | 550 | 6.350 | 92.6 | 481.0 | 27.12 | 6 | 37.56 | 2,220 | 81.9 | 10.40 | 143.6 | .00726 | | |
| 286 | do. | do. | 3 | 60 | 24.65 | 250 | 3,452 | 608.0 | 677 | 8.675 | 88.4 | 686.0 | 26.88 | 8 | 40.15 | 2,004 | 76.1 | 10.40 | 143.6 | .00714 | | |
| 287 | do. | do. | 2 | 40 | 16.4 | 250 | 3,452 | 315.0 | 358 | 2.600 | 121.1 | 260.0 | 26.38 | 7 | 41.24 | 1,893 | 75.4 | 6.14 | 161.0 | .00556 | | |
| 288 | do. | do. | 2 | 60 | 24.65 | 250 | 3,452 | 439.0 | 485 | 6.840 | 114.2 | 405.0 | 25.15 | 7 | 41.24 | 1,893 | 75.4 | 10.18 | 169.0 | .00515 | | |
| 289 | do. | do. | 2 | 80 | 32.8 | 250 | 3,452 | 560.0 | 609 | 8.520 | 85.9 | 675.0 | 25.15 | 7 | 41.24 | 1,932 | 77.0 | 13.18 | 147.6 | .00495 | | |
| 290 | do. | do. | 2 | 100 | 41.0 | 250 | 3,452 | 610.0 | 699 | 11.40 | 78.6 | 823.0 | 25.15 | 6 | 41.24 | 1,978 | 78.7 | 13.59 | 150.3 | .00452 | | |
| 291 | do. | do. | 3 | 54 | 22.15 | 250 | 3,452 | 554.0 | 610 | 4.755 | 116.4 | 482.0 | 25.15 | 6 | 41.24 | 1,972 | 78.5 | 9.25 | 161.1 | .00725 | | |

| | 1 92 | Diamond point, cut 6 to inch. | 2 100 | 41.0 | 250 | 3, 452 | 650.0 | 723 | Qualitative run; no production data. | 27.51 | 62 | 27.47 | 126.5 | .00460 |
|-------|--|---|--------|-------|-----|--------|-------|-----|--------------------------------------|-------|----|-------|--------|--------|
| 1 93 | do. | Stone dressed..... | 2 20 | 8.2 | 250 | 3, 452 | 256.5 | 286 | 75.5 | 27.51 | 62 | 27.47 | 136.0 | .00906 |
| 1 94 | Spiral, cut 6 to inch. | Same surface..... | 2 100 | 41.0 | 250 | 3, 435 | 572.5 | 633 | 405.0 | 27.51 | 62 | 27.47 | 107.6 | .00407 |
| 1 95 | do. | Stone dressed..... | 2 20 | 8.2 | 250 | 3, 435 | 232.5 | 278 | 58.3 | 27.51 | 62 | 27.47 | 110.6 | .00826 |
| 1 96 | Straight, cut 3 to inch; spiral, cut 12 to inch. | Stone dressed..... | 2 40 | 16.4 | 200 | 2, 748 | 310.0 | 390 | 390.0 | 27.51 | 62 | 27.47 | 113.6 | .00687 |
| 1 112 | do. | Same as No. 111..... | 3 40 | 16.4 | 200 | 2, 748 | 326.0 | 392 | 4, 320 | 27.00 | 58 | 23.84 | 84.3 | .00723 |
| 2 114 | do. | Same as No. 113..... | 2 20 | 16.4 | 225 | 2, 748 | 342.0 | 388 | 4, 625 | 27.19 | 58 | 39.66 | 2, 270 | .00758 |
| 2 120 | do. | Same as No. 119..... | 2 25 | 49.2 | 225 | 3, 092 | 307.0 | 370 | 5, 260 | 25.05 | 58 | 39.66 | 2, 282 | .00758 |
| 2 121 | do. | Same surface..... | 2 25 | 36.5 | 225 | 3, 092 | 347.0 | 392 | 5, 280 | 25.05 | 6 | 40.34 | 2, 130 | .00460 |
| 2 122 | do. | do. | 3 36.5 | 14.98 | 225 | 3, 092 | 335.0 | 411 | 3, 770 | 25.05 | 6 | 40.34 | 2, 093 | .00724 |
| 2 123 | do. | do. | 3 60 | 24.65 | 225 | 3, 092 | 493.0 | 556 | 5, 665 | 24.84 | 6 | 43.02 | 1, 805 | .00646 |
| 2 124 | do. | Stone dressed..... | 3 60 | 24.65 | 225 | 3, 085 | 595.0 | 665 | 7, 485 | 24.84 | 6 | 43.02 | 1, 898 | .00781 |
| 2 125 | do. | Same surface..... | 3 40 | 16.4 | 225 | 3, 085 | 419.0 | 475 | 4, 390 | 24.84 | 6 | 43.02 | 2, 058 | .00826 |
| 2 126 | do. | do. | 3 20 | 8.2 | 225 | 3, 085 | 232.0 | 290 | 1, 703 | 24.84 | 6 | 43.02 | 1, 928 | .00916 |
| 2 127 | do. | do. | 3 60 | 24.65 | 225 | 3, 085 | 597.0 | 629 | 8, 161 | 25.01 | 5 | 29.09 | 2, 405 | .00745 |
| 2 128 | do. | do. | 3 40 | 16.4 | 225 | 3, 085 | 417.0 | 464 | 6, 950 | 25.01 | 5 | 29.09 | 2, 402 | .00825 |
| 2 129 | do. | do. | 3 20 | 8.2 | 225 | 3, 085 | 231.0 | 264 | 1, 517 | 25.01 | 5 | 29.09 | 2, 360 | .00913 |
| 2 133 | do. | Same as No. 132..... | 3 40 | 16.4 | 225 | 3, 085 | 413.0 | 496 | 4, 750 | 27.66 | 4 | 28.08 | 3, 370 | .00816 |
| 2 134 | do. | Same surface..... | 3 60 | 24.65 | 225 | 3, 085 | 411.0 | 478 | 4, 210 | 27.66 | 4 | 28.08 | 3, 380 | .00813 |
| 2 135 | do. | do. | 2 40 | 16.4 | 225 | 3, 085 | 403.0 | 470 | 5, 765 | 27.96 | 4 | 26.41 | 2, 460 | .00530 |
| 2 136 | do. | do. | 2 60 | 24.65 | 225 | 3, 085 | 416.0 | 472 | 5, 785 | 27.96 | 4 | 26.41 | 2, 430 | .00547 |
| 2 137 | do. | do. | 3 20 | 8.2 | 175 | 2, 400 | 338.0 | 384 | 1, 465 | 28.04 | 5 | 27.75 | 2, 470 | .00855 |
| 2 138 | do. | do. | 3 40 | 16.4 | 175 | 2, 400 | 338.0 | 384 | 1, 435 | 28.04 | 5 | 27.75 | 2, 470 | .00855 |
| 2 139 | do. | do. | 3 60 | 24.65 | 175 | 2, 400 | 462.0 | 515 | 5, 805 | 28.04 | 5 | 27.75 | 2, 470 | .00855 |
| 2 140 | do. | do. | 3 20 | 8.2 | 175 | 2, 400 | 180.0 | 225 | 1, 419 | 28.04 | 5 | 27.75 | 2, 470 | .00855 |
| 2 141 | do. | do. | 3 40 | 16.4 | 175 | 2, 400 | 323.0 | 346 | 3, 495 | 28.04 | 5 | 27.75 | 2, 450 | .00915 |
| 2 142 | do. | do. | 3 60 | 24.65 | 175 | 2, 400 | 465.0 | 515 | 5, 775 | 28.04 | 5 | 27.75 | 2, 450 | .00821 |
| 2 143 | do. | Same as No. 142..... | 3 60 | 24.65 | 225 | 3, 083 | 572.0 | 651 | 6, 575 | 26.97 | 5 | 27.75 | 2, 435 | .00751 |
| 2 144 | do. | Same surface..... | 3 80 | 24.65 | 225 | 3, 083 | 553.0 | 634 | 6, 585 | 26.97 | 5 | 27.05 | 2, 325 | .00729 |
| 2 145 | do. | do. | 3 60 | 24.65 | 225 | 3, 085 | 586.0 | 665 | 7, 405 | 26.97 | 5 | 27.05 | 2, 370 | .00770 |
| 2 146 | do. | do. | 3 30 | 20.5 | 100 | 1, 371 | 247.5 | 283 | 2, 570 | 27.19 | 5 | 26.12 | 2, 350 | .00880 |
| 2 147 | do. | do. | 3 50 | 20.5 | 130 | 2, 056 | 254.0 | 295 | 2, 880 | 27.19 | 5 | 26.12 | 2, 350 | .00603 |
| 2 148 | do. | do. | 1 50 | 20.5 | 250 | 3, 427 | 222.0 | 254 | 2, 590 | 27.19 | 6 | 26.12 | 2, 370 | .00316 |
| 2 149 | do. | do. | 2 50 | 20.5 | 100 | 1, 371 | 266.0 | 284 | 2, 617 | 27.19 | 6 | 26.12 | 2, 340 | .00945 |
| 2 150 | do. | do. | 2 90 | 20.5 | 130 | 2, 056 | 263.0 | 284 | 2, 685 | 27.19 | 6 | 26.12 | 2, 360 | .00624 |
| 2 151 | do. | do. | 2 50 | 20.5 | 250 | 3, 427 | 226.0 | 262 | 2, 405 | 27.19 | 5 | 26.12 | 2, 335 | .00322 |
| 2 152 | do. | Same as white birch No. 2..... | 3 30 | 12.3 | 225 | 3, 085 | 324.0 | 365 | 1, 890 | 24.13 | 9 | 32.00 | 1, 983 | .00853 |
| 2 153 | do. | Same as tamarack, No. 26..... | 3 30 | 12.3 | 225 | 3, 085 | 298.0 | 340 | 1, 233 | 26.91 | 5 | 22.93 | 2, 120 | .00785 |
| 2 154 | do. | Same surface..... | 2 100 | 41.0 | 225 | 3, 085 | 652.0 | 706 | 6, 490 | 26.91 | 5 | 22.93 | 2, 035 | .00515 |
| 2 155 | Straight, cut 3 to inch; spiral, cut 10 to inch. | Same as run No. 12 M on tan a lodgepole pine..... | 3 40 | 16.4 | 225 | 3, 085 | 444.0 | 489 | 2, 205 | 26.91 | 5 | 22.10 | 2, 270 | .00876 |
| 2 156 | do. | Same surface..... | 3 40 | 16.4 | 225 | 3, 085 | 382.0 | 446 | 1, 825 | 26.20 | 4 | 22.10 | 2, 240 | .00754 |
| 2 157 | do. | do. | 2 80 | 32.8 | 225 | 3, 085 | 511.0 | 571 | 3, 850 | 26.20 | 5 | 22.10 | 2, 270 | .00505 |
| 2 158 | do. | do. | 2 80 | 32.8 | 225 | 3, 085 | 474.0 | 509 | 4, 160 | 26.20 | 5 | 22.10 | 2, 290 | .00463 |
| 2 159 | Straight, cut 3 to inch; spiral, cut 12 to inch. | Stone dressed..... | 3 30 | 12.3 | 250 | 3, 427 | 316.0 | 368 | 2, 685 | 25.14 | 6 | 34.14 | 2, 110 | .00750 |

1 Seasoned wood used.

2 Green wood used.

TABLE 5.—Grinder runs on white spruce—Continued.

| Run No. | Kind of burr. | Stone. | Number of pockets used. | | | | | | | | | | Pressure on 14-inch cylinder. | | Pressure per square inch of pocket area. | | Revolutions per minute. | | Peripheral speed. | | Average horsepower to grinder. | | Maximum horsepower to grinder. | | Bone-dry pulp in 24 hours. | | Horsepower per ton bone-dry pulp in 24 hours. | | Solid rossed wood ground in 24 hours. | | Weight per cubic foot bone-dry wood. | | Average diameter of wood. | | Moisture in wood. | | Bone-dry pulp per 100 cubic feet solid rossed wood. | | Efficiency of conversion. | | Screens per 100 cubic feet solid rossed wood, bone-dry. | | Average temperature of grinding. | | Horsepower divided by pressure X speed. | |
|---------|--|-----------------------------|-------------------------|--|--|--|--|--|--|--|--|---|-------------------------------|-------|--|-------|--------------------------------|-------|-------------------|-------|---|-------|--------------------------------|-------|----------------------------|-------|---|-----------|---------------------------------------|-----------|--------------------------------------|-----------|---------------------------|--|-------------------|--|---|--|---------------------------|--|---|--|----------------------------------|--|---|--|
| | | | Lbs. per sq. in. | | | | | | | | | | Lbs. | Lbs. | Feet per minute. | | Average horsepower to grinder. | | Tons. | | Horsepower per ton bone-dry pulp in 24 hours. | | Cu. ft. | | Lbs. | Lbs. | In. | Per cent. | Lbs. | Per cent. | Lbs. | Per cent. | ° F. | | | | | | | | | | | | | |
| 1160 | Straight, cut 3 to inch; spiral, cut 10 to inch. | Surface. | Same surface..... | | | | | | | | | | 3 | 30 | 12.3 | 250 | 3,427 | 308.0 | 338 | 2,250 | 136.8 | 190.3 | 26.48 | 51 | 31.12 | 2,365 | 87.1 | 11.37 | 158.30 | .00730 | | | | | | | | | | | | | | | | |
| 1161 | do..... | | do..... | | | | | | | | | | 3 | 35 | 14.35 | 214 | 2,936 | 328.0 | 368 | 2,210 | 148.2 | 191.6 | 26.48 | 43 | 31.12 | 2,310 | 87.1 | 9.10 | 178.2 | .00779 | | | | | | | | | | | | | | | | |
| 1162 | do..... | | do..... | | | | | | | | | | 3 | 40 | 16.4 | 188 | 2,530 | 317.0 | 350 | 2,425 | 130.8 | 206.0 | 26.48 | 53 | 31.12 | 2,350 | 88.7 | 9.81 | 169.3 | .00750 | | | | | | | | | | | | | | | | |
| 1163 | do..... | | do..... | | | | | | | | | | 3 | 45 | 18.45 | 167 | 2,290 | 339.0 | 380 | 2,823 | 120.0 | 230.0 | 26.48 | 53 | 31.12 | 2,455 | 92.6 | 13.26 | 166.6 | .00802 | | | | | | | | | | | | | | | | |
| 1164 | do..... | | do..... | | | | | | | | | | 3 | 50 | 20.5 | 150 | 2,056 | 323.0 | 361 | 2,445 | 132.1 | 204.5 | 26.48 | 53 | 31.12 | 2,385 | 90.1 | 11.62 | 158.2 | .00767 | | | | | | | | | | | | | | | | |
| 1165 | do..... | | do..... | | | | | | | | | | 3 | 55 | 22.55 | 136 | 1,867 | 310.0 | 347 | 2,265 | 136.7 | 196.0 | 26.48 | 53 | 31.12 | 2,310 | 87.1 | 11.70 | 165.1 | .00764 | | | | | | | | | | | | | | | | |
| 1166 | do..... | | do..... | | | | | | | | | | 3 | 60 | 24.65 | 125 | 1,714 | 323.0 | 386 | 2,775 | 116.5 | 236.0 | 26.48 | 53 | 31.12 | 2,350 | 88.7 | 16.45 | 155.1 | .00764 | | | | | | | | | | | | | | | | |
| 1167 | Diamond point, cut 8 to inch. | | Same as No. 176... | | | | | | | | | | 2 | 20 | 8.2 | 225 | 3,085 | 157.5 | 194 | .760 | 207.0 | 68.7 | 27.54 | 43 | 27.98 | 2,210 | 80.3 | 10.75 | 161.2 | .00622 | | | | | | | | | | | | | | | | |
| 1178 | do..... | | Same surface..... | | | | | | | | | | 2 | 40 | 16.4 | 225 | 3,085 | 280.0 | 314 | 2,240 | 125.0 | 193.0 | 27.54 | 43 | 27.98 | 2,315 | 84.9 | 9.02 | 160.0 | .00553 | | | | | | | | | | | | | | | | |
| 1179 | do..... | | do..... | | | | | | | | | | 2 | 60 | 24.65 | 225 | 3,085 | 387.0 | 455 | 4,095 | 94.5 | 342.0 | 27.54 | 43 | 27.98 | 2,390 | 86.9 | 10.27 | 137.5 | .00508 | | | | | | | | | | | | | | | | |
| 1180 | do..... | do..... | | | | | | | | | | 2 | 80 | 32.8 | 225 | 3,085 | 485.0 | 530 | 5,545 | 87.5 | 408.0 | 27.54 | 53 | 27.98 | 2,370 | 86.0 | 10.90 | 126.4 | .00479 | | | | | | | | | | | | | | | | | |
| 1181 | do..... | do..... | | | | | | | | | | 2 | 100 | 40.0 | 225 | 3,085 | 563.0 | 630 | 7,450 | 75.5 | 645.0 | 27.54 | 53 | 27.98 | 2,310 | 83.9 | 16.57 | 126.7 | .00445 | | | | | | | | | | | | | | | | | |
| 1210 | Spiral, cut 8 to inch. | Stone dressed | | | | | | | | | | 3 | 50 | 20.5 | 200 | 2,728 | 410.0 | 469 | 1,260 | 325.0 | Axis of wood perpendicular to axis of stone. | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1222 | Straight, cut 3 to inch; spiral, cut 12 to inch. | do..... | | | | | | | | | | 2 | 80 | 32.8 | 225 | 3,069 | 474.0 | 566 | 6,610 | 71.6 | 551.0 | 25.37 | 63 | 32.24 | 2,400 | 94.6 | 14.65 | 146.0 | .00470 | | | | | | | | | | | | | | | | | |
| 1243 | Spiral, cut 8 to inch; straight, cut 10 to inch. | Same as lowland fit No. 17. | | | | | | | | | | 2 | 40 | 16.4 | 175 | 2,348 | 219.0 | 263 | 1,750 | 125.0 | 148.0 | 25.63 | 47 | 34.83 | 2,365 | 92.2 | 7.10 | 138.0 | .00569 | | | | | | | | | | | | | | | | | |
| 1244 | do..... | Same surface..... | | | | | | | | | | 2 | 60 | 24.65 | 175 | 2,348 | 306.0 | 346 | 3,145 | 97.3 | 261.0 | 25.63 | 43 | 34.83 | 2,412 | 94.0 | 12.10 | 142.0 | .00528 | | | | | | | | | | | | | | | | | |
| 1245 | do..... | do..... | | | | | | | | | | 2 | 80 | 32.8 | 175 | 2,348 | 370.0 | 436 | 4,375 | 84.5 | 360.0 | 25.63 | 53 | 34.83 | 2,430 | 94.8 | 13.10 | 142.0 | .00540 | | | | | | | | | | | | | | | | | |
| 1246 | do..... | do..... | | | | | | | | | | 2 | 60 | 24.65 | 100 | 1,342 | 212.0 | 238 | 2,175 | 97.4 | 181.0 | 25.63 | 43 | 34.83 | 2,410 | 94.0 | 10.60 | 145.0 | .00640 | | | | | | | | | | | | | | | | | |
| 1247 | do..... | do..... | | | | | | | | | | 2 | 60 | 24.65 | 250 | 3,355 | 411.0 | 465 | 3,870 | 106.0 | 315.0 | 25.63 | 43 | 34.83 | 2,460 | 96.0 | 9.10 | 130.0 | .00497 | | | | | | | | | | | | | | | | | |
| 1248 | do..... | Stone dressed | | | | | | | | | | 2 | 60 | 24.65 | 175 | 2,348 | 316.0 | 372 | 4,740 | 66.5 | 420.0 | 25.63 | 43 | 34.83 | 2,260 | 88.1 | 8.2 | 96.0 | .00545 | | | | | | | | | | | | | | | | | |
| 1249 | do..... | do..... | | | | | | | | | | 2 | 60 | 24.65 | 175 | 2,348 | 321.0 | 380 | 1,700 | 189.0 | 189.0 | 25.63 | 53 | 34.83 | 1,803 | 70.4 | 7.9 | 73.0 | .00534 | | | | | | | | | | | | | | | | | |
| 1250 | do..... | Same surface..... | | | | | | | | | | 2 | 60 | 24.65 | 175 | 2,348 | 312.0 | 400 | 2,030 | 153.7 | 187.0 | 25.63 | 43 | 34.83 | 2,170 | 84.6 | 7.6 | 151.0 | .00538 | | | | | | | | | | | | | | | | | |
| 1251 | do..... | do..... | | | | | | | | | | 2 | 60 | 24.65 | 175 | 2,348 | 304.0 | 369 | 2,080 | 146.0 | 191.0 | 25.63 | 43 | 34.83 | 2,150 | 83.9 | 10.4 | 170.0 | .00524 | | | | | | | | | | | | | | | | | |
| 1252 | do..... | do..... | | | | | | | | | | 3 | 50 | 20.50 | 225 | 3,020 | 436.0 | 531 | 2,025 | 215.0 | 193.0 | 25.50 | 53 | 33.1 | 2,120 | 82.6 | 8.2 | 176.0 | .00705 | | | | | | | | | | | | | | | | | |
| 1253 | do..... | do..... | | | | | | | | | | 3 | 50 | 20.50 | 225 | 3,020 | 437.0 | 550 | 2,560 | 178.5 | 226.0 | 25.50 | 53 | 33.1 | 2,260 | 88.1 | 6.4 | 154.0 | .00739 | | | | | | | | | | | | | | | | | |
| 1254 | do..... | do..... | | | | | | | | | | 3 | 50 | 20.50 | 225 | 3,020 | 527.0 | 641 | 2,570 | 905.0 | 242.0 | 25.50 | 53 | 33.1 | 2,200 | 82.6 | 6.4 | 180.0 | .00852 | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | |
|-------|---|---|----|-------|-----|-------|-------|-----|--------|-------|-------|-------|------------------|-------|-------|------|------|-------|--------|
| 2 255 |do..... | 3 | 40 | 16.40 | 175 | 2,348 | 238.0 | 314 | 2,845 | 90.6 | 391.0 | 18.60 | 12 $\frac{1}{2}$ | 30.80 | 1,455 | 78.3 | 12.3 | 130.0 | .00670 |
| 2 256 |do..... | 3 | 40 | 16.40 | 175 | 2,348 | 290.0 | 342 | 2,250 | 129.0 | 194.0 | 23.83 | 4 $\frac{1}{2}$ | 29.66 | 2,320 | 89.9 | 14.2 | 147.0 | .00753 |
| 1 257 | Straight, cut 3 to inch; spiral, cut 12 to inch. | 3 | 20 | 8.20 | 175 | 2,425 | 176.0 | 204 | 1,190 | 148.0 | 111.0 | 24.36 | 4 $\frac{1}{2}$ | 28.73 | 2,140 | 88.0 | 22.5 | 170.0 | .00885 |
| 1 258 |do..... | 3 | 40 | 16.40 | 175 | 2,425 | 331.0 | 415 | 3,450 | 96.0 | 318.0 | 24.36 | 41 | 28.73 | 2,170 | 89.1 | 35.9 | 156.0 | .00832 |
| 1 259 |do..... | 3 | 60 | 24.65 | 175 | 2,425 | 514.0 | 565 | 7,460 | 68.8 | 670.0 | 24.36 | 43 | 28.73 | 2,230 | 91.6 | 74.0 | 152.0 | .00839 |
| 1 260 |do..... | 3 | 40 | 16.40 | 100 | 1,387 | 235.0 | 277 | 2,410 | 97.5 | 220.0 | 24.36 | 43 | 28.73 | 2,185 | 88.9 | 32.6 | 157.0 | .01032 |
| 1 261 |do..... | 3 | 40 | 16.40 | 150 | 2,080 | 358.0 | 392 | 4,270 | 83.6 | 393.0 | 24.36 | 43 | 28.73 | 2,160 | 88.8 | 56.6 | 150.0 | .01049 |
| 1 262 |do..... | 3 | 40 | 16.40 | 200 | 2,774 | 426.0 | 478 | 4,820 | 88.3 | 433.0 | 24.36 | 43 | 28.73 | 2,220 | 91.2 | 30.0 | 145.0 | .00936 |
| 1 263 |do..... | 3 | 40 | 16.40 | 250 | 3,468 | 490.0 | 522 | 6,355 | 76.7 | 573.0 | 24.36 | 43 | 28.73 | 2,222 | 91.3 | 34.9 | 140.0 | .00861 |
| 1 264 | Stone dressed..... | 2 | 60 | 24.65 | 225 | 3,120 | 418.0 | 459 | 7,870 | 53.2 | 814.0 | 24.36 | 43 | 28.73 | 1,680 | 78.3 | 43.9 | 131.0 | .00543 |
| 1 276 |do..... | 2 | 20 | 8.20 | 225 | 3,120 | 151.0 | 198 | 1,750 | 86.0 | 117.0 | 25.11 | 43 | 28.88 | 2,380 | 94.8 | 11.5 | 133.0 | .00590 |
| 1 277 |do..... | 2 | 40 | 16.40 | 225 | 3,120 | 310.0 | 353 | 4,295 | 72.2 | 448.0 | 25.11 | 41 | 28.88 | 1,920 | 76.5 | 27.3 | 128.0 | .00606 |
| 1 278 |do..... | 2 | 60 | 24.65 | 225 | 3,120 | 469.0 | 530 | 9,040 | 52.0 | 769.0 | 25.11 | 43 | 28.88 | 2,354 | 95.8 | 32.4 | 127.0 | .00609 |
| 1 279 |do..... | 2 | 80 | 32.80 | 225 | 3,120 | 542.0 | 606 | 11,800 | 46.0 | 982.0 | 25.11 | 43 | 28.88 | 2,400 | 95.6 | 31.0 | 122.0 | .00530 |
| 1 280 |do..... | 3 | 30 | 12.32 | 200 | 2,774 | 296.0 | 361 | 3,580 | 82.7 | 304.0 | 25.11 | 43 | 28.88 | 2,360 | 94.0 | 9.1 | 72.0 | .00867 |
| 1 281 |do..... | 3 | 30 | 12.32 | 200 | 2,774 | 312.0 | 370 | 3,675 | 85.0 | 310.0 | 25.11 | 43 | 28.88 | 2,360 | 94.0 | 11.4 | 133.0 | .00913 |
| 1 282 |do..... | 3 | 30 | 12.32 | 200 | 2,774 | 308.0 | 364 | 3,000 | 103.0 | 260.0 | 25.11 | 43 | 28.88 | 2,300 | 91.6 | 19.8 | 168.0 | .00902 |

¹ Seasoned wood used.² Partially decayed wood used.

Runs 257-282 were run on a coarse-grit stone.

TABLE 6.—Grinder runs on spruce wood—cooked prior to grinding.

| Grinder run No. | Cooking treatment. | | Kind of burr. | Stone. | Number of pockets used. | Pressure on 14-inch cylinder. | Revolutions per minute. | Average horsepower to grinder. | Tons. | Bone-dry pulp in 24 hours. | Horsepower per ton bone-dry pulp in 24 hours. | Solid-rosed wood ground in 24 hours. | Weight wood (bone-dry) per cubic foot of wood. | Average diameter of wood. | Moisture in wood. | Pulp bone-dry per 100 cubic feet of solid-rosed wood. | Efficiency of conversion. | Screenings bone-dry per 100 cubic feet solid-rosed wood. | Average temperature of grinding. | Horsepower divided by pressure \times speed. |
|-----------------|--------------------|-------------------|---|--|-------------------------|-------------------------------|-------------------------|--------------------------------|-------|----------------------------|---|--------------------------------------|--|---------------------------|-------------------|---|---------------------------|--|----------------------------------|--|
| | Kind of cook. | Duration of cook. | | | | Lbs. per sq. in. | | | | | | | | | Per cent. | Lbs. | Per cent. | Lbs. | ° F. | |
| 151 | Steamed. | 8 | Straight, cut 3 to in.; spiral cut, 12 to in. | Same as for tamarack No. 23. | 3 | 40 | 200 | 326 | 372 | 3.130 | 104.0 | 340.0 | 22.96 | 54 | 39.08 | 1,840 | 80.2 | 18.47 | 156.6 | 0.00719 |
| 157 | Boiled. | 4 | do. | Same as for spruce No. 56. | 3 | 40 | 200 | 335 | 394 | 3.380 | 99.2 | 296.0 | 27.11 | 51 | 25.31 | 2,283 | 84.4 | 23.60 | 156.0 | 0.00739 |
| 172 | Steamed. | 8 | do. | Same as for western yellow pine No. 3. | 3 | 40 | 200 | 301 | 358 | 2.250 | 133.9 | 250.0 | 25.06 | 6 | 30.36 | 1,800 | 71.9 | 16.15 | 166.4 | 0.00664 |
| 173 | do. | 2 | do. | Same as for white birch No. 1. | 3 | 40 | 200 | 353 | 415 | 2.800 | 126.0 | 264.0 | 26.84 | 58 | 30.73 | 2,122 | 79.0 | 19.25 | 164.1 | 0.00777 |
| 177 | do. | 4 | do. | Same as for spruce No. 76. | 3 | 40 | 175 | 172 | 212 | 2.784 | 220.0 | 79.2 | 26.06 | 51 | 31.29 | 1,980 | 76.0 | 12.48 | 171.0 | 0.00871 |
| 178 | do. | 4 | do. | Same surface. | 3 | 40 | 175 | 299 | 349 | 2.155 | 138.8 | 208.5 | 27.48 | 6 | 28.61 | 2,066 | 75.2 | 18.19 | 158.2 | 0.00755 |
| 179 | do. | 4 | do. | do. | 3 | 60 | 175 | 373 | 449 | 2.935 | 127.1 | 292.0 | 27.14 | 6 | 28.83 | 2,013 | 74.2 | 23.90 | 149.4 | 0.00626 |
| 397 | do. | 6 | do. | Stone dressed. | 2 | 20 | 225 | 153 | 180 | 1.803 | 84.9 | 197.8 | 26.66 | 6 | 36.51 | 1,823 | 68.4 | 10.08 | 131.5 | 0.00605 |
| 398 | do. | 6 | do. | Same surface. | 2 | 20 | 225 | 230 | 272 | 3.365 | 68.1 | 352.0 | 27.19 | 7 | 39.66 | 1,910 | 70.3 | 18.32 | 121.1 | 0.00452 |
| 399 | do. | 6 | do. | do. | 2 | 60 | 225 | 308 | 360 | 4.020 | 76.7 | 426.0 | 27.19 | 7 | 39.66 | 1,883 | 68.4 | 27.37 | 120.2 | 0.00404 |
| 3100 | do. | 6 | do. | do. | 2 | 60 | 225 | 369 | 401 | 4.655 | 79.1 | 496.0 | 27.19 | 61 | 39.66 | 1,876 | 69.0 | 34.00 | 125.1 | 0.00364 |
| 3101 | do. | 6 | do. | do. | 2 | 100 | 225 | 420 | 510 | 4.615 | 90.9 | 487.0 | 27.19 | 61 | 39.66 | 1,896 | 69.7 | 45.85 | 128.4 | 0.00332 |
| 3102 | do. | 6 | do. | Stone dressed. | 3 | 40 | 200 | 280 | 320 | 3.075 | 91.1 | 376.0 | 25.06 | 61 | 44.00 | 1,636 | 65.3 | 18.57 | 125.0 | 0.00621 |
| 3103 | do. | 2 | do. | Same surface. | 3 | 40 | 200 | 332 | 382 | 4.195 | 79.1 | 378.0 | 27.81 | 61 | 26.22 | 2,219 | 79.7 | 12.28 | 128.7 | 0.00736 |
| 3104 | do. | 4 | do. | do. | 3 | 40 | 200 | 323 | 393 | 4.210 | 76.7 | 390.0 | 27.81 | 61 | 26.22 | 2,160 | 77.6 | 16.86 | 126.1 | 0.00716 |
| 3105 | do. | 6 | do. | do. | 3 | 40 | 200 | 327 | 364 | 3.995 | 81.8 | 422.0 | 27.81 | 55 | 26.22 | 1,892 | 68.0 | 10.36 | 137.0 | 0.00725 |
| 3106 | do. | 8 | do. | do. | 3 | 40 | 200 | 329 | 382 | 3.595 | 89.1 | 345.0 | 27.30 | 55 | 27.56 | 2,081 | 76.3 | 17.81 | 137.8 | 0.00710 |
| 3107 | do. | 12 | do. | do. | 3 | 40 | 200 | 323 | 398 | 3.565 | 90.6 | 344.0 | 27.30 | 55 | 27.56 | 2,263 | 85.5 | 16.53 | 144.9 | 0.00752 |
| 3108 | do. | 2 | do. | do. | 3 | 40 | 200 | 339 | 393 | 3.810 | 89.0 | 337.0 | 26.50 | 55 | 23.88 | 2,170 | 79.5 | 13.80 | 134.0 | 0.00681 |
| 3109 | do. | 4 | do. | do. | 3 | 40 | 200 | 307 | 363 | 3.705 | 82.9 | 342.0 | 26.50 | 55 | 23.88 | 2,105 | 79.5 | 15.80 | 142.2 | 0.00632 |
| 3110 | do. | 6 | do. | do. | 3 | 40 | 200 | 285 | 342 | 2.927 | 97.4 | 278.0 | 26.50 | 55 | 23.88 | 2,000 | 75.5 | 12.98 | 139.5 | 0.00610 |
| 3111 | do. | 6 | do. | do. | 3 | 40 | 200 | 275 | 323 | 3.037 | 96.6 | 304.0 | 26.50 | 55 | 23.88 | 2,098 | 75.5 | 10.40 | 143.7 | 0.00639 |
| 3112 | do. | 12 | do. | Same as for spruce No. 112. | 3 | 40 | 200 | 288 | 342 | 2.985 | 96.5 | 299.0 | 26.50 | 55 | 23.88 | 1,998 | 75.5 | 10.96 | 137.9 | 0.00632 |
| 3115 | do. | 2 | do. | Same as for spruce No. 114. | 3 | 40 | 200 | 294 | 368 | 3.760 | 90.1 | 314.0 | 27.19 | 61 | 39.66 | 2,080 | 76.5 | 10.30 | 140.8 | 0.00559 |
| 3116 | do. | 4 | do. | Same surface. | 3 | 40 | 200 | 252 | 303 | 2.475 | 101.9 | 270.0 | 25.05 | 61 | 39.66 | 1,830 | 73.2 | 19.30 | 130.1 | 0.00601 |
| 3117 | do. | 6 | do. | do. | 3 | 40 | 200 | 271 | 328 | 2.540 | 106.7 | 285.0 | 25.05 | 61 | 40.34 | 1,722 | 68.3 | 11.13 | 138.1 | 0.00601 |
| 3118 | do. | 8 | do. | do. | 3 | 40 | 200 | 283 | 329 | 2.775 | 102.0 | 325.0 | 25.05 | 6 | 40.34 | 1,710 | 68.3 | 14.76 | 138.6 | 0.00627 |

[illegible]

Green wood was ground with bark on.

³ Green wood used.

soda-ash solution.

2 Boiled in a

TABLE 6.—Grinder runs on spruce wood—cooked prior to grinding—Continued.

| Grinder run No. | Cooking treatment. | | Stone. | Number of pockets used. | Pressure on 14-inch cylinder lbs. per sq. in. | Revolutions per minute. | | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton bone-dry pulp in 24 hours. | Solid-rossed wood ground in 24 hours. | Weight per cubic foot of wood (bone-dry). | Average diameter of wood. | Moisture in wood. | Pulp bone-dry per 100 cubic feet of solid-rossed wood. | Efficiency of conversion. | Screens per bone-dry per 100 cubic feet solid-rossed wood. | Average temperature of grinding. | Horsepower divided by speed. |
|-----------------|--------------------|-----------------|--------|-------------------------|--|-------------------------|-------------------|--------------------------------|--------------------------------|----------------------------|---|---------------------------------------|---|---------------------------|-------------------|--|---------------------------|--|----------------------------------|------------------------------|
| | Kind of cook. | Gauge pressure. | | | | Kind of burr. | Surface of stone. | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| 1215 | Steamed | 2 | 2 | Same surface. | 60 | 174 | 274½ | 327 | 3,118 | 88.1 | 270.0 | 26.50 | 61 | 30.90 | Per cent. | 14.16 | 136.4 | 0.00469 | | |
| 1216 | do. | 0 | 0 | do. | 60 | 171 | 275 | 332 | 3,300 | 83.4 | 278.0 | 26.50 | 71 | 30.90 | do. | 10.82 | 144.0 | 0.0147 | | |
| 1217 | do. | 12 | 2 | do. | 60 | 225 | 320 | 361 | 3,300 | 97.0 | 357.0 | 26.50 | 73 | 30.90 | do. | 12.06 | 136.4 | 0.0122 | | |
| 1218 | do. | 75 | 2 | do. | 60 | 219 | 250 | 318 | 2,793 | 100.2 | 298.0 | 26.50 | 69 | 30.90 | do. | 14.40 | 133.1 | 0.0380 | | |
| 1219 | do. | 75 | 2 | do. | 60 | 214 | 274 | 327 | 2,192 | 125.0 | 234.0 | 26.50 | 80 | 30.90 | do. | 11.43 | 140.7 | 0.0383 | | |
| 1220 | do. | 4 | 2 | do. | 60 | 210 | 280 | 342 | 2,500 | 108.5 | 262.0 | 26.50 | 80 | 30.90 | do. | 13.45 | 136.0 | 0.0306 | | |
| 1221 | do. | 4 | 2 | do. | 60 | 187 | 280 | 367 | 2,395 | 88.5 | 270.0 | 26.50 | 70 | 30.90 | do. | 12.10 | 140.0 | 0.0345 | | |
| 1222 | do. | 75 | 2 | Stone dressed | 60 | 225 | 277 | 348 | 3,130 | 88.5 | 271.0 | 25.20 | 51 | 31.69 | do. | 18.90 | 131.0 | 0.0368 | | |
| 1223 | do. | 6 | 2 | do. | 60 | 207 | 281 | 345 | 3,150 | 89.6 | 312.0 | 25.20 | 53 | 31.69 | do. | 27.00 | 131.0 | 0.0406 | | |
| 1224 | do. | 6 | 2 | Same surface. | 60 | 200 | 276 | 327 | 3,195 | 72.0 | 332.0 | 25.20 | 53 | 31.69 | do. | 17.50 | 137.0 | 0.0461 | | |
| 1225 | do. | 6 | 2 | do. | 60 | 173 | 277 | 331 | 3,895 | 72.0 | 318.0 | 25.20 | 53 | 31.69 | do. | 4.80 | 136.0 | 0.0537 | | |
| 1226 | do. | 20 | 2 | do. | 60 | 216 | 277 | 332 | 3,055 | 90.7 | 284.0 | 25.20 | 49 | 34.69 | do. | 19.30 | 133.0 | 0.0383 | | |
| 1227 | do. | 3 | 2 | do. | 60 | 201 | 250 | 333 | 3,225 | 86.8 | 308.0 | 25.20 | 53 | 34.69 | do. | 22.60 | 135.0 | 0.0383 | | |
| 1228 | do. | 3 | 2 | do. | 60 | 173 | 278 | 328 | 3,355 | 82.9 | 300.0 | 25.20 | 53 | 34.69 | do. | 15.10 | 136.0 | 0.0463 | | |
| 1229 | do. | 3 | 2 | do. | 60 | 164 | 277 | 335 | 3,480 | 79.5 | 300.0 | 25.20 | 53 | 34.69 | do. | 11.10 | 141.0 | 0.0504 | | |
| 1230 | do. | 3 | 2 | do. | 60 | 157 | 278 | 328 | 3,980 | 69.9 | 328.0 | 25.20 | 51 | 34.69 | do. | 9.90 | 133.0 | 0.0529 | | |
| 1231 | do. | 3 | 2 | do. | 60 | 225 | 345 | 404 | 3,710 | 93.0 | 336.0 | 25.66 | 51 | 31.12 | do. | 27.6 | 146.0 | 0.0458 | | |
| 1232 | do. | 75 | 2 | Stone dressed | 60 | 210 | 348 | 415 | 3,540 | 98.3 | 334.0 | 25.66 | 5 | 31.12 | do. | 20.4 | 138.0 | 0.0495 | | |
| 1233 | do. | 6 | 2 | Same surface. | 60 | 206 | 344 | 390 | 3,510 | 88.9 | 323.0 | 25.66 | 5 | 31.12 | do. | 17.5 | 140.0 | 0.0500 | | |
| 1234 | do. | 6 | 2 | do. | 60 | 187 | 344 | 409 | 4,150 | 82.9 | 364.0 | 25.66 | 5 | 31.12 | do. | 25.2 | 141.0 | 0.0550 | | |
| 1235 | do. | 20 | 2 | do. | 60 | 178 | 339 | 385 | 4,080 | 83.0 | 343.0 | 25.66 | 5 | 31.12 | do. | 23.8 | 142.0 | 0.0570 | | |
| 1236 | do. | 75 | 2 | do. | 60 | 205 | 347 | 398 | 3,710 | 93.5 | 362.0 | 25.66 | 5 | 31.12 | do. | 20.6 | 142.0 | 0.0506 | | |
| 1237 | do. | 3 | 2 | do. | 60 | 192 | 344 | 408 | 4,050 | 85.0 | 376.0 | 25.66 | 5 | 31.12 | do. | 27.3 | 137.0 | 0.0535 | | |
| 1238 | do. | 3 | 2 | do. | 60 | 191 | 342 | 388 | 4,150 | 82.5 | 365.0 | 25.66 | 4 | 31.12 | do. | 21.9 | 134.0 | 0.0535 | | |
| 1239 | do. | 3 | 2 | do. | 60 | 188 | 347 | 390 | 4,300 | 80.7 | 360.0 | 25.66 | 6 | 31.12 | do. | 23.0 | 138.0 | 0.0552 | | |
| 1240 | do. | 3 | 2 | do. | 60 | 176 | 354 | 398 | 4,300 | 81.2 | 378.0 | 25.66 | 4 | 31.12 | do. | 15.0 | 129.0 | 0.0600 | | |
| 1241 | do. | 0 | 0 | do. | 60 | 188 | 347 | 390 | 4,300 | 80.7 | 360.0 | 25.66 | 6 | 31.12 | do. | 23.0 | 138.0 | 0.0552 | | |
| 1242 | do. | 0 | 0 | do. | 60 | 176 | 354 | 398 | 4,300 | 81.2 | 378.0 | 25.66 | 4 | 31.12 | do. | 15.0 | 129.0 | 0.0600 | | |

| 12 265 | 1 266 | 1 267 | 1 268 | 1 269 | 1 270 | 1 271 | 1 272 | 1 273 | 1 274 | 1 275 | 8 | 60 | Straight, cut 3 to in., spral, cut 12 to in. | Stone dressed | 2 | 60 | 225 334 | 376 | 5. 735 | 58. 3 | 641. 0 | 24. 36 | 42 | 28. 73 | 1. 788 | 73. 413. 0 | 122. 0 | . 00434 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---|----|---|---------------|---|----|---------|-----|--------|-------|--------|--------|----|--------|--------|-------------|--------|---------|
| do. | do. | do. | do. | do. | do. | do. | do. | do. | do. | do. | 6 | 60 | do. | Stone dressed | 2 | 60 | 217 336 | 402 | 5. 875 | 57. 3 | 630. 0 | 24. 36 | 42 | 28. 73 | 1. 867 | 76. 6119. 7 | 125. 0 | . 00452 |
| do. | do. | do. | do. | do. | do. | do. | do. | do. | do. | do. | 4 | 60 | do. | Same surface. | 2 | 60 | 202 336 | 373 | 5. 840 | 57. 6 | 622. 0 | 24. 36 | 42 | 28. 73 | 1. 878 | 77. 1154. 3 | 125. 0 | . 00486 |
| do. | do. | do. | do. | do. | do. | do. | do. | do. | do. | do. | 2 | 60 | do. | do. | 2 | 60 | 191 328 | 373 | 6. 615 | 49. 6 | 601. 0 | 24. 36 | 42 | 28. 73 | 2. 200 | 90. 4 53. 3 | 125. 0 | . 00502 |
| do. | do. | do. | do. | do. | do. | do. | do. | do. | do. | do. | 0 | 0 | do. | do. | 2 | 60 | 181 339 | 409 | 6. 910 | 49. 0 | 605. 0 | 24. 36 | 42 | 28. 73 | 2. 280 | 93. 6 55. 0 | 130. 0 | . 00548 |
| do. | do. | do. | do. | do. | do. | do. | do. | do. | do. | do. | 6 | 60 | do. | do. | 2 | 60 | 200 261 | 319 | 4. 050 | 64. 5 | 421. 0 | 25. 11 | 5 | 28. 88 | 1. 920 | 76. 5118. 2 | 122. 0 | . 00575 |
| do. | do. | do. | do. | do. | do. | do. | do. | do. | do. | do. | 6 | 60 | do. | do. | 2 | 60 | 200 320 | 374 | 5. 645 | 56. 8 | 579. 0 | 25. 11 | 5 | 28. 88 | 1. 950 | 77. 7143. 8 | 113. 0 | . 00468 |
| do. | do. | do. | do. | do. | do. | do. | do. | do. | do. | do. | 6 | 60 | do. | do. | 2 | 60 | 200 379 | 430 | 6. 500 | 58. 3 | 685. 0 | 25. 11 | 5 | 28. 88 | 1. 900 | 75. 7212. 0 | 126. 0 | . 00417 |
| do. | do. | do. | do. | do. | do. | do. | do. | do. | do. | do. | 6 | 60 | do. | do. | 2 | 60 | 189 320 | 362 | 5. 600 | 57. 4 | 563. 0 | 25. 11 | 42 | 28. 88 | 1. 990 | 79. 4244. 0 | 126. 0 | . 00495 |
| do. | do. | do. | do. | do. | do. | do. | do. | do. | do. | do. | 6 | 40 | do. | do. | 2 | 60 | 171 326 | 357 | 5. 910 | 55. 1 | 583. 0 | 25. 11 | 5 | 28. 88 | 2. 220 | 88. 4183. 0 | 110. 0 | . 00558 |
| do. | do. | do. | do. | do. | do. | do. | do. | do. | do. | do. | 0 | 0 | do. | do. | 2 | 60 | 168 324 | 357 | 6. 110 | 53. 0 | 534. 0 | 25. 11 | 53 | 28. 88 | 2. 285 | 91. 1 33. 2 | 119. 0 | . 00564 |

² Runs 265 to 275, inclusive, were ground on a coarse grit stone.

¹ Seasoned wood used.

TABLE 7.—*Quality tests—white spruce.*

| Grinder run No. | Paper machine run No. | Ground wood in total furnish. | Weight per ream. | Thickness. | Mullen test. | | | Schopper tests. | | | | | | Tintometer indications. | | | | | |
|-----------------|-----------------------|-------------------------------|------------------|------------|--------------|------------------------------|------------|--|------------------|---------|---------|------------|-------------|--|---------------------------------|--------|--------|--------|--------|
| | | | | | Total. | Per 0.001 inch of thickness. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | | Stretch. | | Breaking weight per square millimeter, sectional area. | Breaking length per horsepower. | Red. | Green. | Blue. | Black. |
| | | | | | | | | | Meters. | Meters. | Meters. | Crosswise. | Lengthwise. |  |  |  |  |  |  | Average. | Per ct. | Per ct. |
| | | Per ct. | Lbs. | Inch. | Points. | Points. | Point. | Meters. | Meters. | Meters. | Per ct. | Per ct. | Grams. | Meters. | Parts. | Parts. | Parts. | Parts. | |
| 1 | 110 | 80 | 32.0 | 0.00387 | 12.15 | 3.14 | 0.380 | 256.0 | 2,600 | 4,000 | 3.00 | 1.40 | 1,506 | 33.9 | 95 | 86 | 78 | 41 | |
| 2 | 62 | 80 | 32.0 | 0.0036 | 16.4 | 4.55 | 0.513 | 306.0 | 3,075 | 5,300 | 2.04 | 1.22 | 2,050 | 26.7 | 89 | 80 | 73 | 58 | |
| 3 | 75 | 80 | 37.0 | 0.0041 | 19.35 | 4.72 | 0.523 | 210.0 | 3,585 | 6,040 | 1.98 | 1.04 | 2,440 | 43.8 | 87 | 76 | 66 | 71 | |
| 4 | 42 | 80 | 29.0 | 0.0038 | 11.3 | 2.97 | 0.390 | 221.0 | 2,420 | 4,640 | 3,530 | 0.98 | 1.36 | 1,462 | 40.8 | 89 | 68 | 65 | |
| 5 | 11 | 80 | 40.0 | 0.0047 | 21.4 | 4.55 | 0.535 | 351.0 | 2,500 | 5,440 | 3,970 | 1.10 | 1.14 | 1,936 | 21.2 | 90 | 80 | 60 | |
| 6 | 7 | 80 | 33.0 | 0.0038 | 15.7 | 4.13 | 0.476 | 229.0 | 3,120 | 6,210 | 1,76 | 1.06 | 1,141 | 42.8 | 88 | 79 | 69 | 64 | |
| 7 | 22 | 79 | 33.0 | 0.0043 | 14.05 | 3.27 | 0.544 | 323.0 | 2,673 | 4,780 | 3,727 | 1.66 | 1.10 | 1,590 | 40.9 | 87 | 77 | 64 | |
| 8 | 56 | 80 | 34.0 | 0.00384 | 17.95 | 4.72 | 0.544 | 323.0 | 3,344 | 5,690 | 4,517 | 2.86 | 1.58 | 2,350 | 25.7 | 82 | 71 | 61 | |
| 9 | 31 | 80 | 35.0 | 0.0038 | 17.50 | 3.74 | 0.493 | 189.0 | 3,040 | 5,410 | 4,225 | 1.38 | 1.04 | 1,272 | 45.2 | 96 | 75 | 50 | |
| 9-1 | 16 | 80 | 33.0 | 0.00394 | 14.15 | 3.60 | 0.429 | 174.0 | 2,973 | 5,358 | 1,40 | 1.04 | 1,122 | 55.9 | 81 | 73 | 66 | 80 | |
| 10 | 72 | 80 | 34.0 | 0.0042 | 12.35 | 2.94 | 0.363 | 180.0 | 2,123 | 4,335 | 2,229 | 2.92 | 1.22 | 1,360 | 49.3 | 91 | 78 | 61 | |
| 10-1 | 45 | 80 | 34.0 | 0.00417 | 15.65 | 3.75 | 0.460 | 163.0 | 3,180 | 5,320 | 1,78 | 1.22 | 1,501 | 56.6 | 97 | 85 | 76 | 42 | |
| 11 | 92 | 80 | 34.0 | 0.0040 | 13.00 | 2.75 | 0.382 | 176.0 | 2,655 | 5,030 | 3,843 | 1.98 | 1.10 | 1,680 | 57.3 | 90 | 79 | 66 | |
| 12 | 20 | 80 | 34.0 | 0.0047 | 13.00 | 2.77 | 0.382 | 170.0 | 2,065 | 4,325 | 3,195 | 1.12 | 1.53 | 1,320 | 48.2 | 90 | 79 | 69 | |
| 13 | 28 | 80 | 34.0 | 0.00414 | 11.45 | 2.77 | 0.358 | 181.0 | 2,228 | 4,020 | 3,124 | 1.02 | 1.38 | 1,240 | 48.2 | 90 | 80 | 74 | |
| 14 | 29 | 80 | 32.0 | 0.00414 | 16.55 | 4.83 | 0.552 | 231.0 | 3,865 | 5,750 | 4,808 | 2.22 | 1.10 | 2,340 | 51.3 | 84 | 72 | 66 | |
| 15 | 61 | 80 | 38.0 | 0.0043 | 17.45 | 4.06 | 0.459 | 192.0 | 3,865 | 5,960 | 4,529 | 2.16 | 1.26 | 2,114 | 37.7 | 85 | 75 | 64 | |
| 16 | 15 | 80 | 33.0 | 0.0043 | 14.40 | 4.47 | 0.406 | 196.0 | 2,395 | 5,795 | 3,095 | 2.40 | 1.26 | 2,114 | 37.7 | 85 | 75 | 64 | |
| 17 | 48 | 80 | 29.0 | 0.00298 | 13.50 | 4.40 | 0.500 | 224.0 | 3,085 | 5,850 | 4,408 | 1.76 | 1.06 | 1,940 | 38.8 | 88 | 73 | 65 | |
| 18 | 73 | 80 | 35.0 | 0.0033 | 16.35 | 4.12 | 0.467 | 192.0 | 3,350 | 5,360 | 4,355 | 2.00 | 1.16 | 2,119 | 39.9 | 86 | 77 | 70 | |
| 19 | 20 | 80 | 31.0 | 0.0039 | 13.90 | 3.86 | 0.448 | 183.0 | 3,865 | 4,855 | 3,860 | 1.94 | 1.00 | 2,085 | 48.5 | 95 | 82 | 75 | |
| 20 | 44 | 80 | 44.0 | 0.0045 | 25.6 | 5.69 | 0.582 | 249.0 | 3,384 | 6,680 | 5,032 | 2.56 | 1.47 | 1,613 | 47.1 | 92 | 82 | 71 | |
| 21 | 21 | 80 | 33.0 | 0.00354 | 17.15 | 4.85 | 0.520 | 273.0 | 3,400 | 5,850 | 4,625 | 2.02 | 1.43 | 2,700 | 34.8 | 87 | 78 | 67 | |
| 22 | 77 | 80 | 33.0 | 0.00355 | 18.70 | 5.27 | 0.567 | 236.0 | 3,570 | 5,910 | 4,740 | 2.22 | 1.24 | 2,350 | 32.6 | 82 | 69 | 61 | |
| 23 | 67 | 80 | 33.0 | 0.0037 | 16.75 | 4.53 | 0.508 | 196.0 | 3,165 | 5,430 | 4,298 | 2.46 | 1.32 | 2,420 | 35.3 | 84 | 75 | 70 | |
| 24 | 59 | 80 | 33.0 | 0.0037 | 18.70 | 4.53 | 0.513 | 174.0 | 3,045 | 4,840 | 3,943 | 2.22 | 1.17 | 2,010 | 43.1 | 86 | 74 | 67 | |
| 25 | 50 | 80 | 31.0 | 0.00373 | 15.9 | 4.30 | 0.487 | 178.0 | 3,040 | 5,630 | 4,943 | 2.18 | 1.18 | 1,850 | 44.1 | 78 | 66 | 58 | |
| 26 | 35 | 80 | 36.0 | 0.0041 | 17.9 | 4.36 | 0.497 | 175.0 | 3,000 | 5,620 | 4,325 | 1.60 | 1.10 | 2,150 | 48.7 | 88 | 75 | 64 | |
| 27 | 8 | 80 | 33.0 | 0.0042 | 13.85 | 3.30 | 0.420 | 194.0 | 2,400 | 5,018 | 3,732 | 1.24 | 1.01 | 2,150 | 45.8 | 85 | 71 | 55 | |
| 28 | 93 | 80 | 35.0 | 0.0039 | 18.2 | 4.67 | 0.520 | 229.0 | 2,965 | 5,200 | 3,833 | 2.00 | 1.08 | 2,185 | 32.1 | 95 | 79 | 68 | |
| 29 | 96 | 80 | 32.0 | 0.00365 | 16.1 | 4.41 | 0.503 | 230.0 | 3,570 | 5,480 | 4,525 | 2.04 | 1.12 | 2,170 | 37.6 | 98 | 79 | 71 | |
| 29-1 | 64 | 80 | 31.0 | 0.0036 | 15.15 | 4.21 | 0.489 | 201.0 | 3,195 | 5,020 | 4,108 | 2.22 | 1.14 | 1,975 | 32.2 | 85 | 76 | 68 | |

| | | | | | | | | | | | | | | | | | | | |
|----|-----|------|--------|-------|-------|-------|-------|-------|-------|-------|------|------|------|-------|-------|----|----|----|-----|
| 30 | 58 | 31.0 | .00364 | 15.00 | 4.17 | .484 | 191.0 | 3,295 | 5,400 | 4,348 | 2.12 | 1.14 | 1.63 | 1,914 | 47.0 | 87 | 78 | 67 | 68 |
| 31 | 66 | 31.0 | .0035 | 13.25 | 3.79 | .427 | 234.0 | 3,050 | 5,450 | 4,255 | 1.72 | 1.08 | 1.40 | 1,928 | 42.5 | 91 | 80 | 72 | 57 |
| 32 | 65 | 31.0 | .0041 | 8.5 | 2.07 | .274 | 220.0 | 3,065 | 5,450 | 4,255 | 1.12 | .94 | 1.03 | 1,220 | 48.2 | 87 | 78 | 71 | 64 |
| 33 | 24 | 30 | .0045 | 10.0 | 2.22 | .306 | 188.0 | 2,180 | 4,230 | 3,205 | 1.36 | .88 | 1.12 | 1,254 | 56.2 | 87 | 77 | 69 | 67 |
| 34 | 32 | 33.0 | .0047 | 10.75 | 2.29 | .326 | 186.0 | 2,140 | 4,000 | 3,070 | 1.30 | .88 | 1.04 | 1,260 | 50.6 | 90 | 76 | 66 | 68 |
| 35 | 23 | 30 | .0044 | 11.7 | 2.66 | .354 | 183.5 | 2,282 | 4,600 | 3,441 | 1.48 | .96 | 1.22 | 1,365 | 53.1 | 83 | 72 | 61 | 84 |
| 36 | 30 | 32.0 | .0041 | 11.45 | 2.73 | .358 | 181.0 | 2,294 | 4,935 | 3,615 | 1.48 | 1.00 | 1.24 | 1,500 | 55.8 | 90 | 79 | 70 | 61 |
| 37 | 52 | 34.0 | .0043 | 12.35 | 2.87 | .363 | 174.0 | 2,560 | 4,060 | 3,380 | 2.04 | 1.12 | 1.52 | 1,414 | 53.5 | 86 | 74 | 66 | 74 |
| 38 | 55 | 34.0 | .00436 | 12.35 | 2.83 | .363 | 174.0 | 2,560 | 3,970 | 3,265 | 1.96 | 1.08 | 1.52 | 1,340 | 53.5 | 88 | 76 | 64 | 72 |
| 39 | 69 | 34.0 | .0044 | 11.60 | 2.64 | .341 | 197.0 | 2,300 | 4,725 | 2,950 | 1.78 | 1.08 | 1.43 | 1,236 | 49.5 | 83 | 70 | 61 | 86 |
| 40 | 14 | 30.0 | .00363 | 9.95 | 2.74 | .331 | 221.0 | 2,500 | 4,635 | 3,693 | 1.44 | .98 | 1.01 | 1,570 | 49.5 | 81 | 70 | 62 | 87 |
| 41 | 39 | 30.0 | .0044 | 13.80 | 3.14 | .380 | 232.0 | 2,750 | 4,635 | 3,693 | 1.44 | .98 | 1.21 | 1,615 | 48.22 | 89 | 71 | 63 | 82 |
| 42 | 74 | 30.0 | .0039 | 12.10 | 3.10 | .442 | 229.0 | 2,773 | 5,280 | 3,578 | 1.46 | 1.08 | 1.27 | 1,610 | 53.1 | 84 | 71 | 63 | 82 |
| 43 | 39 | 31.0 | .0035 | 13.70 | 3.91 | .442 | 229.0 | 2,773 | 5,280 | 3,578 | 1.46 | 1.08 | 1.27 | 1,610 | 53.1 | 84 | 71 | 63 | 82 |
| 44 | 25 | 30 | .0037 | 13.8 | 3.73 | .431 | 235.0 | 2,810 | 5,010 | 4,010 | 2.14 | 1.32 | 1.73 | 1,910 | 39.6 | 88 | 80 | 70 | 61 |
| 45 | 52 | 31.0 | .0036 | 11.9 | 3.30 | .384 | 224.0 | 2,630 | 5,170 | 3,910 | 2.40 | 1.00 | 1.20 | 1,695 | 45.5 | 84 | 72 | 62 | 83 |
| 46 | 46 | 30.0 | .0037 | 15.95 | 4.31 | .455 | 353.0 | 3,055 | 4,950 | 4,003 | 2.72 | 1.36 | 2.04 | 2,010 | 25.0 | 79 | 69 | 59 | 93 |
| 47 | 44 | 30.0 | .0038 | 14.45 | 4.30 | .452 | 197.0 | 5,280 | 5,135 | 3,858 | 2.54 | 1.22 | 1.88 | 1,710 | 40.7 | 87 | 79 | 70 | 64 |
| 48 | 60 | 32.0 | .0040 | 13.6 | 3.40 | .425 | 188.0 | 2,714 | 4,620 | 3,517 | 2.54 | 1.54 | 2.04 | 1,545 | 44.0 | 80 | 75 | 66 | 72 |
| 49 | 49 | 32.0 | .0036 | 14.6 | 4.05 | .456 | 288.0 | 3,455 | 5,415 | 4,435 | 2.02 | 1.00 | 1.51 | 2,200 | 33.8 | 80 | 70 | 61 | 89 |
| 50 | 41 | 30.0 | .00356 | 14.7 | 4.11 | .462 | 246.0 | 3,014 | 5,280 | 4,147 | 2.14 | 1.28 | 1.71 | 1,940 | 36.5 | 84 | 73 | 68 | 75 |
| 51 | 85 | 30.0 | .0037 | 14.8 | 3.68 | .444 | 210.0 | 2,890 | 5,300 | 4,095 | 2.68 | 1.16 | 1.92 | 1,840 | 44.0 | 86 | 79 | 69 | 66 |
| 52 | 97 | 30.0 | .00295 | 17.35 | 5.55 | .569 | 366.0 | 3,525 | 4,805 | 4,165 | 1.92 | .84 | 1.38 | 2,880 | 23.0 | 83 | 76 | 68 | 73 |
| 53 | 63 | 30.0 | .00365 | 11.25 | 5.88 | .495 | 366.0 | 3,525 | 4,805 | 4,165 | 1.92 | .84 | 1.38 | 2,880 | 23.0 | 83 | 76 | 68 | 73 |
| 54 | 82 | 30.0 | .00423 | 13.30 | 3.35 | .388 | 270.0 | 2,925 | 5,155 | 4,040 | 1.84 | 1.14 | 1.49 | 1,810 | 38.6 | 89 | 79 | 69 | 63 |
| 55 | 68 | 30.0 | .0039 | 8.9 | 3.14 | .380 | 180.0 | 2,985 | 4,580 | 3,783 | 1.84 | 1.16 | 1.50 | 1,728 | 55.5 | 83 | 73 | 69 | 75 |
| 56 | 71 | 30.0 | .0048 | 10.5 | 2.28 | .306 | 195.0 | 2,445 | 4,260 | 3,353 | 1.50 | 1.02 | 1.26 | 1,395 | 56.2 | 88 | 78 | 71 | 63 |
| 57 | 58 | 31.0 | .0041 | 16.45 | 2.48 | .326 | 175.0 | 2,300 | 4,060 | 3,180 | 1.18 | .92 | 1.05 | 1,394 | 55.8 | 86 | 74 | 66 | 74 |
| 58 | 83 | 32.0 | .00417 | 11.45 | 4.01 | .470 | 211.0 | 2,245 | 5,350 | 4,298 | 2.26 | 1.18 | 1.72 | 1,934 | 43.3 | 82 | 68 | 63 | 87 |
| 59 | 167 | 35.0 | .00417 | 11.45 | 2.74 | .358 | 173.0 | 2,715 | 4,385 | 3,550 | 1.44 | 1.00 | 1.22 | 1,517 | 57.2 | 87 | 75 | 68 | 70 |
| 60 | 86 | 30.0 | .0036 | 13.85 | 3.85 | .461 | 199.5 | 3,110 | 5,190 | 4,150 | 1.82 | 1.20 | 1.51 | 2,000 | 45.1 | 91 | 81 | 72 | 56 |
| 61 | 87 | 30.0 | .00375 | 15.95 | 4.25 | .493 | 189.0 | 3,010 | 5,000 | 4,055 | 2.04 | 1.36 | 1.78 | 1,953 | 44.3 | 91 | 79 | 74 | 56 |
| 62 | 81 | 30.0 | .00416 | 14.05 | 3.28 | .413 | 210.0 | 3,040 | 4,865 | 3,953 | 2.04 | 1.18 | 1.61 | 1,755 | 45.5 | 91 | 78 | 69 | 62 |
| 63 | 67 | 30.0 | .0040 | 12.15 | 3.04 | .380 | 215.0 | 2,910 | 5,040 | 3,975 | 1.52 | 1.10 | 1.31 | 1,712 | 48.6 | 85 | 76 | 67 | 73 |
| 64 | 76 | 30.0 | .00365 | 11.95 | 3.28 | .412 | 191.0 | 2,760 | 4,635 | 3,697 | 1.60 | 1.02 | 1.31 | 1,640 | 47.0 | 88 | 76 | 67 | 69 |
| 65 | 6 | 30.0 | .0040 | 11.40 | 2.85 | .345 | 233.0 | 2,445 | 4,822 | 3,677 | 1.63 | 1.01 | 1.32 | 1,569 | 45.1 | 87 | 75 | 66 | 72 |
| 66 | 57 | 30.0 | .00425 | 14.05 | 3.31 | .326 | 194.5 | 2,910 | 4,635 | 3,773 | 2.00 | 1.10 | 1.55 | 1,640 | 45.5 | 84 | 72 | 62 | 82 |
| 67 | 4 | 35.0 | .0032 | 12.35 | 2.38 | .353 | 211.0 | 2,155 | 4,218 | 3,187 | 1.55 | 1.02 | 1.19 | 1,395 | 42.8 | 86 | 76 | 66 | 73 |
| 68 | 13 | 30.0 | .0047 | 14.75 | 3.14 | .434 | 188.5 | 2,730 | 4,450 | 3,467 | 1.72 | 1.06 | 1.39 | 1,610 | 46.4 | 89 | 79 | 70 | 62 |
| 69 | 12 | 32.0 | .0043 | 12.8 | 2.98 | .400 | 171.5 | 2,485 | 4,450 | 3,467 | 1.58 | .96 | 1.27 | 1,510 | 48.3 | 92 | 83 | 73 | 52 |
| 70 | 3 | 32.0 | .0042 | 9.2 | 2.18 | .288 | 219.0 | 2,603 | 4,065 | 3,074 | 1.26 | .98 | 1.11 | 1,203 | 48.8 | 84 | 76 | 76 | 66 |
| 71 | 10 | 30.0 | .0046 | 11.15 | 2.42 | .328 | 185.5 | 2,045 | 4,150 | 3,088 | 1.64 | .98 | 1.31 | 1,310 | 50.8 | 84 | 74 | 74 | 66 |
| 72 | 166 | 30.0 | .00354 | 18.30 | 5.169 | .4946 | 271.0 | 3,050 | 5,206 | 4,128 | 2.08 | 1.18 | 1.63 | 2,308 | 30.8 | 46 | 31 | 24 | 199 |
| 73 | 70 | 30.0 | .00458 | 19.00 | 4.150 | .576 | 218.0 | 3,780 | 3,890 | 3,890 | 2.42 | 1.26 | 1.84 | 1,940 | 30.9 | 57 | 45 | 39 | 169 |
| 74 | 175 | 30.0 | .00369 | 10.15 | 2.750 | .3170 | 283.0 | 1,985 | 3,705 | 2,845 | 2.00 | 1.10 | 1.55 | 1,421 | 31.7 | 68 | 61 | 54 | 117 |
| 75 | 176 | 80 | .00374 | 15.00 | 4.01 | .4415 | 258.0 | 2,898 | 4,852 | 3,875 | 2.30 | 1.30 | 1.80 | 1,982 | 34.1 | 68 | 66 | 56 | 115 |
| 76 | 177 | 80 | .00348 | 17.25 | 4.83 | .507 | 371.0 | 2,965 | 5,635 | 4,300 | 2.56 | 1.36 | 1.75 | 2,235 | 22.8 | 67 | 66 | 56 | 120 |
| 77 | 171 | 80 | .00348 | 17.50 | 5.030 | .505 | 440.0 | 3,100 | 5,430 | 4,265 | 2.16 | 1.54 | 2.05 | 2,340 | 19.4 | 45 | 32 | 27 | 196 |
| 78 | 167 | 80 | .00372 | 19.90 | 5.350 | .5532 | 251.0 | 3,408 | 5,424 | 4,416 | 2.34 | 1.20 | 1.77 | 2,425 | 31.8 | 63 | 44 | 38 | 155 |

TABLE 7.—Quality tests—white spruce—Continued.

| Grinder run No. | Paper machine run No. | Ground wood in total furnish. | Weight per ream. | Thickness. | Mullen test. | | | | Schopper tests. | | | | | | Tintometer indications. | | | | | |
|-----------------|-----------------------|-------------------------------|------------------|------------|--------------|------------------------------|------------|--|------------------|-------------|------------|-------------|--|---|-------------------------|--------|-------|--------|----------|---------|
| | | | | | Total. | Per 0.001 inch of thickness. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | Stretch. | | Breaking weight per square millimeter, sectional area. | Breaking length per horsepower per ton. | Red. | Green. | Blue. | Black. | | |
| | | | | | | | | | Crosswise. | Lengthwise. | Crosswise. | Lengthwise. | | | | | | | Average. | |
| | | | | | | | | | | | | | | | | | | | | Meters. |
| 79 | 192 | 80 | 33.0 | 0.0349 | 17.70 | 5.070 | 0.5364 | 237.0 | 3,520 | 6.744 | 5,132 | 1.84 | 1.08 | 1.46 | 2,801 | 40.3 | 53 | 34 | 27 | 186 |
| 80 | 190 | 80 | 31.0 | 0.0326 | 15.85 | 4.86 | 0.5112 | 539.0 | 3,688 | 6,004 | 5,574 | 1.80 | 1.18 | 1.49 | 3,002 | 19.5 | 76 | 70 | 64 | 90 |
| 81 | 191 | 80 | 31.0 | 0.0325 | 13.90 | 3.96 | 0.4484 | 295.0 | 3,459 | 6,631 | 5,045 | 1.94 | 1.06 | 1.50 | 2,439 | 38.1 | 97 | 85 | 70 | 48 |
| 82 | 172 | 80 | 35.0 | 0.0408 | 14.00 | 3.43 | 0.405 | 242.0 | 2,475 | 4,100 | 3,288 | 2.34 | 1.32 | 1.83 | 1,580 | 33.6 | 67 | 55 | 48 | 130 |
| 83 | 184 | 80 | 31.0 | 0.0367 | 11.70 | 3.19 | 0.3775 | 261.0 | 2,995 | 5,100 | 4,047 | 1.72 | 1.04 | 1.38 | 1,891 | 41.0 | 75 | 67 | 61 | 97 |
| 84 | 183 | 80 | 34.0 | 0.0414 | 15.54 | 3.73 | 0.4545 | 258.0 | 2,840 | 5,270 | 4,055 | 1.74 | 1.10 | 1.42 | 1,893 | 34.6 | 78 | 65 | 62 | 95 |
| 85 | 169 | 80 | 35.0 | 0.0429 | 14.20 | 3.312 | 0.4060 | 228.0 | 3,176 | 4,826 | 4,001 | 1.90 | 1.04 | 1.47 | 1,958 | 43.1 | 87 | 76 | 69 | 68 |
| 86 | 178 | 80 | 34.0 | 0.0418 | 14.10 | 3.37 | 0.4100 | 216.0 | 2,890 | 4,585 | 3,870 | 1.72 | 0.98 | 1.35 | 1,725 | 43.7 | 75 | 65 | 60 | 100 |
| 87 | 179 | 80 | 34.0 | 0.0399 | 15.50 | 3.89 | 0.4565 | 265.0 | 3,095 | 5,685 | 4,390 | 1.78 | 1.16 | 1.43 | 2,140 | 36.2 | 86 | 78 | 71 | 65 |
| 88 | 163 | 80 | 30.0 | 0.0367 | 11.80 | 3.217 | 0.3935 | 290.0 | 3,883 | 4,610 | 3,746 | 2.06 | 1.22 | 1.64 | 1,748 | 32.9 | 84 | 74 | 71 | 71 |
| 89 | 180 | 80 | 35.0 | 0.0400 | 14.25 | 3.56 | 0.4070 | 281.0 | 2,578 | 4,600 | 3,519 | 1.82 | 1.18 | 1.50 | 1,803 | 32.8 | 92 | 81 | 73 | 54 |
| 90 | 181 | 80 | 32.0 | 0.0394 | 10.65 | 2.70 | 0.3200 | 268.0 | 2,578 | 4,460 | 3,464 | 1.44 | 0.92 | 1.18 | 1,637 | 41.0 | 85 | 72 | 68 | 75 |
| 91 | 182 | 80 | 32.0 | 0.0417 | 11.25 | 2.70 | 0.3517 | 224.0 | 2,700 | 4,228 | 3,464 | 1.54 | 0.82 | 1.18 | 1,508 | 44.1 | 87 | 78 | 69 | 66 |
| 92 | 198 | 80 | 30.0 | 0.0361 | 12.35 | 3.42 | 0.4117 | 283.0 | 2,862 | 5,722 | 4,292 | 1.58 | 1.01 | 1.31 | 1,743 | 36.9 | 80 | 71 | 68 | 81 |
| 97 | 145 | 80 | 34.0 | 0.0363 | 19.20 | 5.292 | 0.5600 | 150.0 | 2,890 | 6,012 | 4,451 | 2.42 | 1.06 | 1.71 | 2,203 | 52.5 | 61 | 41 | 32 | 166 |
| 98 | 146 | 80 | 34.0 | 0.0349 | 17.30 | 4.957 | 0.5088 | 131.0 | 2,832 | 5,694 | 4,263 | 2.42 | 1.34 | 1.95 | 2,238 | 62.6 | 54 | 35 | 29 | 182 |
| 99 | 193 | 80 | 30.0 | 0.0318 | 13.15 | 4.135 | 0.4385 | 175.0 | 2,881 | 6,287 | 4,584 | 1.88 | 1.02 | 1.35 | 2,421 | 59.7 | 65 | 47 | 35 | 157 |
| 100 | 163 | 80 | 33.0 | 0.0347 | 16.25 | 4.684 | 0.4926 | 161.0 | 2,715 | 5,345 | 4,030 | 2.50 | 1.32 | 1.96 | 2,117 | 51.0 | 54 | 37 | 30 | 179 |
| 101 | 196 | 80 | 31.0 | 0.0337 | 15.20 | 4.51 | 0.4905 | 185.0 | 2,630 | 5,538 | 4,084 | 1.98 | 1.14 | 1.56 | 2,072 | 45.0 | 55 | 38 | 31 | 176 |
| 102 | 186 | 80 | 33.0 | 0.0337 | 16.15 | 4.780 | 0.4895 | 186.0 | 3,114 | 5,732 | 4,423 | 1.80 | 0.96 | 1.38 | 2,350 | 46.5 | 43 | 30 | 22 | 205 |
| 103 | 158 | 80 | 33.0 | 0.0341 | 12.40 | 2.974 | 0.3757 | 211.0 | 2,863 | 5,107 | 3,985 | 1.94 | 1.20 | 1.57 | 1,801 | 50.3 | 78 | 64 | 57 | 101 |
| 104 | 159 | 80 | 34.0 | 0.0350 | 16.50 | 4.715 | 0.4851 | 158.0 | 3,392 | 5,760 | 4,576 | 2.20 | 1.28 | 1.74 | 2,137 | 53.7 | 76 | 64 | 57 | 103 |
| 105 | 187 | 80 | 32.0 | 0.0386 | 16.50 | 4.280 | 0.5100 | 158.0 | 3,575 | 5,945 | 4,760 | 2.20 | 1.28 | 1.92 | 2,339 | 58.3 | 74 | 59 | 50 | 117 |
| 106 | 195 | 80 | 30.0 | 0.0353 | 14.85 | 4.21 | 0.495 | 180.0 | 2,901 | 5,891 | 4,396 | 2.16 | 1.00 | 1.59 | 2,060 | 49.4 | 72 | 58 | 49 | 121 |
| 107 | 195 | 80 | 32.0 | 0.0375 | 14.85 | 4.63 | 0.529 | 171.0 | 3,395 | 5,628 | 4,860 | 2.20 | 0.98 | 1.59 | 2,455 | 53.6 | 68 | 53 | 44 | 135 |
| 108 | 136 | 80 | 31.0 | 0.0386 | 13.95 | 3.616 | 0.4536 | 196.0 | 3,048 | 5,900 | 4,528 | 2.32 | 1.18 | 1.75 | 1,942 | 47.8 | 78 | 62 | 53 | 107 |
| 109 | 139 | 80 | 33.0 | 0.0375 | 17.35 | 4.630 | 0.5253 | 157.5 | 3,155 | 5,960 | 4,528 | 2.48 | 1.24 | 1.86 | 2,203 | 54.6 | 65 | 48 | 41 | 146 |
| 110 | 138 | 80 | 34.0 | 0.0375 | 21.30 | 5.703 | 0.6266 | 155.0 | 3,200 | 6,176 | 4,088 | 2.38 | 1.32 | 1.81 | 2,473 | 48.1 | 59 | 42 | 36 | 163 |
| 111 | 141 | 80 | 34.0 | 0.03645 | 20.45 | 5.612 | 0.6015 | 150.8 | 3,343 | 6,620 | 4,970 | 2.38 | 1.26 | 1.82 | 2,590 | 54.9 | 54 | 38 | 30 | 178 |
| 112 | 144 | 80 | 32.0 | 0.0362 | 18.50 | 5.78 | 0.5781 | 157.0 | 3,270 | 6,100 | 4,685 | 2.18 | 1.22 | 1.70 | 2,490 | 51.6 | 57 | 40 | 30 | 173 |
| 122 | 142 | 80 | 30.0 | 0.0393 | 11.50 | 2.928 | 0.3834 | 197.0 | 2,731 | 4,711 | 3,721 | 1.62 | 0.98 | 1.30 | 1,550 | 49.3 | 88 | 74 | 67 | 71 |

| | | | | | | | | | | | | | | | | | | |
|----------|-----|------|---------|--------|-------|-------|--------|-------|-------|-------|------|------|-------|-------|----|----|-----|-----|
| 113..... | 148 | 32.0 | .00328 | 18.15 | 5.536 | .5674 | 170.0 | 2,860 | 3,865 | 2.42 | 1.36 | 1.89 | 2,130 | 40.0 | 54 | 34 | 27 | 185 |
| 114..... | 149 | 80 | .00398 | 10.25 | 2.578 | .3307 | 223.0 | 2,362 | 3,214 | 1.74 | 1.08 | 1.41 | 1,430 | 43.5 | 85 | 76 | 65 | 74 |
| 115..... | 150 | 80 | .00398 | 14.00 | 3.518 | .4241 | 213.0 | 3,074 | 4,066 | 1.74 | 1.04 | 1.58 | 1,950 | 47.5 | 71 | 63 | 47 | 129 |
| 116..... | 151 | 80 | .00331 | 17.15 | 5.030 | .5500 | 185.0 | 2,774 | 5,874 | 2.54 | 1.12 | 1.83 | 2,236 | 42.5 | 63 | 47 | 129 | 148 |
| 117..... | 152 | 80 | .00337 | 16.95 | 5.030 | .5470 | 185.0 | 2,902 | 5,995 | 1.86 | 1.00 | 1.43 | 2,379 | 41.7 | 51 | 33 | 25 | 191 |
| 118..... | 153 | 80 | .00337 | 14.30 | 4.245 | .4470 | 228.0 | 2,826 | 5,010 | 3.84 | 1.04 | 1.94 | 2,158 | 38.4 | 51 | 33 | 27 | 190 |
| 119..... | 154 | 80 | .00323 | 14.15 | 4.380 | .4430 | 223.0 | 2,768 | 5,010 | 3.78 | 1.02 | 2.07 | 2,122 | 38.0 | 42 | 26 | 20 | 212 |
| 120..... | 155 | 80 | .00422 | 8.35 | 1.979 | .2694 | 216.0 | 2,572 | 3,910 | 3.21 | .92 | 1.33 | 1,731 | 55.6 | 80 | 70 | 61 | 89 |
| 121..... | 156 | 80 | .00422 | 12.20 | 2.843 | .3698 | 178.0 | 2,870 | 4,722 | 3.76 | 1.44 | 1.22 | 1,731 | 57.7 | 85 | 74 | 67 | 74 |
| 122..... | 157 | 80 | .00408 | 12.65 | 3.50 | .419 | 212.0 | 2,580 | 4,565 | 3.58 | 1.06 | 1.82 | 1,590 | 40.1 | 65 | 56 | 52 | 127 |
| 123..... | 158 | 80 | .00416 | 14.25 | 3.040 | .3720 | 234.0 | 3,064 | 4,442 | 3.73 | 1.88 | 1.47 | 1,748 | 43.1 | 80 | 78 | 74 | 150 |
| 124..... | 159 | 80 | .00386 | 12.45 | 3.225 | .3890 | 204.0 | 2,716 | 4,765 | 3.74 | 1.20 | 1.47 | 1,701 | 47.0 | 88 | 82 | 72 | 158 |
| 125..... | 160 | 80 | .00365 | 14.35 | 3.932 | .4630 | 207.0* | 3,268 | 4,764 | 2.72 | 1.36 | 1.70 | 2,080 | 45.8 | 93 | 82 | 70 | 162 |
| 126..... | 161 | 80 | .00315 | 15.35 | 4.369 | .4706 | 284.0 | 3,172 | 5,185 | 2.96 | 1.38 | 2.17 | 2,078 | 30.7 | 91 | 81 | 73 | 165 |
| 127..... | 162 | 80 | .0043 | 13.775 | 3.204 | .4175 | 196.0 | 2,574 | 4,212 | 3.38 | 1.38 | 2.03 | 1,672 | 41.5 | 89 | 75 | 69 | 167 |
| 128..... | 163 | 80 | .00373 | 13.10 | 4.05 | .4660 | 196.0 | 3,257 | 3,385 | 1.421 | .96 | 1.40 | 2,101 | 47.5 | 88 | 72 | 68 | 172 |
| 129..... | 164 | 80 | .00354 | 16.40 | 4.910 | .5200 | 288.0 | 3,810 | 6,348 | 5.019 | 1.14 | 1.76 | 2,448 | 33.3 | 79 | 69 | 57 | 185 |
| 130..... | 165 | 80 | .00352 | 19.40 | 5.514 | .5709 | 193.5 | 3,152 | 6,072 | 2.58 | 1.18 | 1.90 | 2,334 | 47.6 | 61 | 37 | 31 | 169 |
| 131..... | 166 | 80 | .0031 | 19.90 | 6.41 | .663 | 150.0 | 2,684 | 5,350 | 4.017 | 1.90 | 1.36 | 2,195 | 40.5 | 67 | 57 | 49 | 117 |
| 132..... | 167 | 80 | .00332 | 22.3 | 6.72 | .675 | 173.0 | 2,876 | 5,552 | 4.214 | 2.36 | 1.42 | 2,224 | 36.2 | 63 | 46 | 39 | 132 |
| 133..... | 168 | 80 | .00405 | 15.1 | 3.73 | .444 | 196.0 | 2,958 | 4,662 | 3.810 | 1.38 | 1.89 | 2,815 | 43.8 | 94 | 83 | 74 | 149 |
| 134..... | 169 | 80 | .00379 | 11.90 | 3.14 | .3839 | 255.0 | 3,152 | 5,712 | 4.432 | 1.68 | 1.82 | 1,815 | 43.8 | 83 | 72 | 66 | 179 |
| 135..... | 170 | 80 | .00375 | 10.55 | 2.810 | .3518 | 199.0 | 2,700 | 4,591 | 3.645 | 1.58 | 1.29 | 2,068 | 45.3 | 89 | 79 | 69 | 163 |
| 136..... | 171 | 80 | .00455 | 13.35 | 2.93 | .3928 | 183.0 | 2,466 | 3,958 | 3.212 | 2.92 | 1.18 | 2,055 | 1,437 | 87 | 74 | 68 | 171 |
| 137..... | 172 | 80 | .00378 | 16.85 | 4.46 | .5267 | 244.0 | 3,600 | 6,004 | 4.802 | 1.96 | 1.54 | 2,526 | 37.4 | 84 | 74 | 65 | 177 |
| 138..... | 173 | 80 | .00359 | 15.25 | 4.25 | .492 | 200.0 | 3,255 | 4,920 | 4.088 | 2.98 | 1.34 | 2,162 | 1,952 | 86 | 73 | 67 | 174 |
| 139..... | 174 | 80 | .00409 | 16.95 | 4.15 | .514 | 155.0 | 2,962 | 4,776 | 3.869 | 2.74 | 2.05 | 1,830 | 48.6 | 87 | 76 | 66 | 171 |
| 140..... | 175 | 80 | .00356 | 15.00 | 4.212 | .4540 | 263.0 | 3,810 | 5,840 | 4.825 | 1.36 | 1.76 | 2,253 | 38.0 | 87 | 76 | 66 | 171 |
| 141..... | 176 | 80 | .004045 | 15.25 | 3.77 | .4766 | 194.0 | 2,740 | 4,590 | 3.665 | 2.98 | 1.40 | 1,756 | 39.6 | 80 | 78 | 72 | 181 |
| 142..... | 177 | 80 | .0042 | 11.80 | 2.809 | .3689 | 218.0 | 2,452 | 3,968 | 3,210 | 2.44 | 1.30 | 1,871 | 1,495 | 89 | 80 | 78 | 181 |
| 143..... | 178 | 80 | .00426 | 14.8 | 3.47 | .448 | 186.0 | 2,805 | 4,380 | 3,593 | 2.34 | 1.32 | 1,831 | 1,608 | 86 | 76 | 72 | 181 |
| 144..... | 179 | 80 | .00414 | 14.05 | 3.54 | .4725 | 178.0 | 2,712 | 4,350 | 3,531 | 2.44 | 1.40 | 1,921 | 1,600 | 87 | 76 | 72 | 181 |
| 145..... | 180 | 80 | .004185 | 13.175 | 3.149 | .3993 | 196.0 | 2,831 | 4,981 | 3,906 | 1.60 | 1.50 | 1,805 | 49.4 | 88 | 79 | 70 | 183 |
| 146..... | 181 | 80 | .00375 | 12.10 | 3.228 | .3902 | 248.0 | 3,086 | 4,716 | 3,901 | 1.60 | 1.32 | 1,605 | 40.5 | 88 | 79 | 70 | 183 |
| 147..... | 182 | 80 | .00407 | 14.65 | 3.599 | .4187 | 210.0 | 3,266 | 4,680 | 3,973 | 2.84 | 2.03 | 1,917 | 45.0 | 85 | 76 | 68 | 181 |
| 148..... | 183 | 80 | .00405 | 12.50 | 3.087 | .3906 | 220.0 | 2,728 | 4,860 | 3,704 | 2.84 | 1.22 | 1,701 | 1,846 | 83 | 72 | 65 | 180 |
| 149..... | 184 | 80 | .00350 | 11.00 | 3.140 | .3375 | 302.0 | 2,658 | 4,628 | 3,643 | 2.58 | 1.36 | 1,971 | 1,730 | 86 | 66 | 50 | 128 |
| 150..... | 185 | 80 | .00398 | 12.35 | 3.104 | .3559 | 254.0 | 2,964 | 4,554 | 3,800 | 2.20 | 1.10 | 1,907 | 1,848 | 86 | 66 | 50 | 128 |
| 151..... | 186 | 80 | .00418 | 14.70 | 3.518 | .4266 | 217.0 | 3,162 | 4,818 | 3,900 | 2.40 | 1.16 | 1,781 | 1,944 | 84 | 72 | 63 | 187 |
| 152..... | 187 | 80 | .00355 | 15.10 | 4.25 | .4965 | 315.0 | 3,001 | 6,259 | 3,830 | 1.66 | 1.78 | 2,305 | 28.2 | 72 | 63 | 53 | 187 |
| 153..... | 188 | 80 | .0044 | 15.0 | 3.4 | .465 | 228.0 | 2,680 | 4,480 | 3,580 | 2.12 | 1.00 | 1,361 | 33.6 | 62 | 56 | 42 | 161 |
| 154..... | 189 | 80 | .0035 | 17.9 | 5.1 | .51 | 335.0 | 3,280 | 6,030 | 4,660 | 2.66 | 1.58 | 2,122 | 23.0 | 77 | 66 | 58 | 199 |
| 155..... | 190 | 80 | .0039 | 15.4 | 4.0 | .43 | 486.0 | 3,070 | 5,960 | 4,520 | 2.08 | 1.44 | 1,761 | 21.6 | 75 | 63 | 54 | 108 |
| 156..... | 191 | 80 | .0038 | 13.7 | 3.6 | .40 | 332.0 | 3,130 | 5,500 | 4,320 | 1.92 | 1.18 | 1,551 | 2,060 | 80 | 68 | 60 | 92 |
| 157..... | 192 | 80 | .0038 | 12.9 | 3.4 | .39 | 282.0 | 3,100 | 5,500 | 4,300 | 2.10 | 1.22 | 1,880 | 37.8 | 71 | 61 | 53 | 115 |
| 158..... | 193 | 80 | .0038 | 12.9 | 3.4 | .39 | 282.0 | 3,100 | 5,500 | 4,300 | 2.10 | 1.22 | 1,880 | 37.8 | 71 | 61 | 53 | 115 |
| 159..... | 194 | 80 | .0032 | 14.2 | 5.1 | .44 | 267.0 | 2,740 | 4,570 | 3,660 | 2.02 | 1.34 | 2,360 | 31.1 | 74 | 67 | 62 | 97 |
| 160..... | 195 | 80 | .0032 | 16.4 | 5.2 | .53 | 258.0 | 3,420 | 5,250 | 4,340 | 2.76 | 1.28 | 2,602 | 31.8 | 72 | 64 | 60 | 104 |
| 161..... | 196 | 80 | .0033 | 17.6 | 5.4 | .56 | 265.0 | 3,360 | 5,720 | 4,540 | 2.72 | 1.52 | 2,240 | 30.6 | 63 | 63 | 60 | 91 |

192 to 96, inclusive, qualitative grinder runs; no production data.

TABLE 7.—Quality tests—white spruce—Continued.

| Grinder run No. | Paper machine run No. | Ground wood in total | Weight per ream. | Mullen test. | | | Schopper tests. | | | | | | Tintometer indications. | | | | | |
|-----------------|-----------------------|----------------------|------------------|--------------|------------------------------|------------|------------------|-------------|----------|------------|--|--------------------------------|-------------------------|---------|--------|--------|-------------|----------|
| | | | | Total. | Per 0.001 inch of thickness. | Per pound. | Breaking length. | | Stretch. | | Breaking weight per square millimeter, sectional area. | Breaking length per horsepower | Red. | Green. | Blue. | Black. | | |
| | | | | | | | Crosswise. | Lengthwise. | Average. | Crosswise. | | | | | | | Lengthwise. | Average. |
| | | | Lbs. | Inch. | Points. | Points. | Point. | | Meters. | Meters. | Per cent. | Per cent. | Grams. | Meters. | Parts. | Parts. | Parts. | Parts. |
| 62. | 247 | 80 | 30.0 | 0.0031 | 16.2 | 5.3 | 0.55 | 238.0 | 3,270 | 5,340 | 4,300 | 2.46 | 1.40 | 1.93 | 32.9 | 75 | 66 | 98 |
| 63. | 218 | 80 | 37.0 | 0.0037 | 20.4 | 5.5 | .55 | 218.0 | 3,520 | 5,640 | 4,580 | 2.54 | 1.24 | 1.89 | 38.2 | 78 | 71 | 87 |
| 64. | 356 | 80 | 41.0 | 0.0048 | 18.4 | 3.8 | .45 | 204.0 | 2,980 | 5,740 | 4,360 | 1.92 | 1.26 | 1.59 | 33.0 | 77 | 67 | 96 |
| 65. | 359 | 80 | 31.0 | 0.0035 | 16.8 | 4.8 | .54 | 253.0 | 3,200 | 6,090 | 4,680 | 1.98 | 1.26 | 1.62 | 34.2 | 72 | 62 | 111 |
| 66. | 246 | 80 | 28.0 | 0.0031 | 14.8 | 4.8 | .53 | 220.0 | 3,130 | 5,700 | 4,440 | 2.46 | 1.38 | 1.92 | 38.1 | 72 | 65 | 104 |
| 67. | 199 | 100 | 36.6 | 0.0292 | 21.15 | 7.24 | .578 | 566.0 | 3,575 | 7,190 | 5,387 | 1.92 | 1.02 | 1.50 | 16.5 | 44 | 26 | 210 |
| 68. | 200 | 100 | 38.4 | 0.0329 | 22.7 | 6.90 | .591 | 269.0 | 3,340 | 5,750 | 4,545 | 1.78 | .84 | 1.31 | 28.6 | 42 | 26 | 214 |
| 69. | 201 | 100 | 36.4 | 0.0302 | 23.4 | 7.73 | .643 | 174.0 | 2,871 | 6,295 | 4,568 | 1.78 | 1.00 | 1.39 | 41.1 | 38 | 22 | 223 |
| 70. | 202 | 100 | 37.0 | 0.0317 | 17.25 | 5.44 | .4665 | 250.0 | 3,679 | 6,209 | 4,944 | 1.58 | .90 | 1.24 | 42.2 | 39 | 23 | 220 |
| 71. | 203 | 100 | 35.0 | 0.0286 | 13.7 | 4.80 | .3915 | 321.0 | 3,366 | 6,495 | 4,930 | 1.40 | .86 | 1.16 | 39.2 | 40 | 22 | 221 |
| 72. | 204 | 100 | 41.0 | 0.0314 | 20.5 | 6.53 | .500 | 223.0 | 3,623 | 6,345 | 4,984 | 1.42 | .90 | 1.13 | 26.0 | 33 | 19 | 235 |
| 73. | 205 | 100 | 33.6 | 0.0348 | 22.8 | 6.56 | .530 | 229.0 | 3,623 | 7,140 | 5,370 | 1.82 | 1.02 | 1.42 | 44.3 | 35 | 19 | 232 |
| 74. | 206 | 100 | 33.0 | 0.0281 | 18.15 | 6.45 | .5401 | 204.0 | 3,324 | 6,972 | 5,148 | 1.46 | .98 | 1.22 | 46.7 | 41 | 23 | 219 |
| 75. | 207 | 100 | 35.0 | 0.0290 | 21.3 | 7.35 | .609 | 181.0 | 3,546 | 6,495 | 5,020 | 1.80 | .90 | 1.35 | 45.6 | 42 | 24 | 217 |
| 76. | 209 | 100 | 39.4 | 0.0323 | 26.65 | 8.25 | .6765 | 168.0 | 3,620 | 6,255 | 4,938 | 2.00 | 1.08 | 2.03 | 43.3 | 46 | 30 | 201 |
| 77. | 226 | 80 | 31.0 | 0.032 | 17.9 | 5.6 | .57 | 363.0 | 3,390 | 6,500 | 4,980 | 2.00 | 1.24 | 1.62 | 24.0 | 75 | 65 | 100 |
| 78. | 229 | 80 | 34.0 | 0.0336 | 17.3 | 4.6 | .51 | 245.0 | 3,080 | 5,440 | 4,260 | 2.12 | 1.26 | 1.69 | 34.1 | 81 | 74 | 68 |
| 79. | 228 | 80 | 32.0 | 0.0336 | 15.9 | 4.4 | .50 | 180.0 | 3,680 | 5,600 | 4,340 | 2.00 | 1.26 | 1.63 | 45.9 | 78 | 68 | 92 |
| 80. | 227 | 80 | 32.0 | 0.0336 | 15.3 | 4.2 | .48 | 182.0 | 3,280 | 5,800 | 4,540 | 2.18 | 1.30 | 1.74 | 51.9 | 74 | 66 | 100 |
| 81. | 230 | 80 | 37.0 | 0.0339 | 12.2 | 3.1 | .38 | 199.0 | 2,630 | 4,370 | 3,500 | 1.72 | 1.08 | 1.40 | 46.4 | 81 | 73 | 78 |
| 82. | 210 | 100 | 43.0 | 0.0331 | 27.0 | 7.95 | .63 | 226.0 | 3,805 | 6,740 | 5,310 | 3.04 | 1.08 | 2.06 | 36.6 | 41 | 25 | 216 |
| 83. | 208 | 100 | 35.0 | 0.0331 | 25.25 | 8.12 | .7215 | 140.0 | 3,105 | 5,523 | 4,814 | 1.92 | 1.22 | 1.57 | 47.7 | 47 | 29 | 204 |
| 84. | 201 | 100 | 38.0 | 0.0335 | 27.8 | 8.0 | .72 | 142.0 | 3,750 | 5,780 | 4,620 | 2.08 | 1.42 | 2.05 | 45.2 | 46 | 29 | 204 |
| 85. | 202 | 100 | 42.0 | 0.0340 | 32.4 | 6.9 | .68 | 130.0 | 3,150 | 6,130 | 4,640 | 3.08 | 1.08 | 2.53 | 55.5 | 48 | 32 | 24 |
| 86. | 259 | 100 | 48.0 | 0.044 | 32.8 | 7.45 | .68 | 119.0 | 3,460 | 6,190 | 4,700 | 3.38 | 1.38 | 2.88 | 57.9 | 46 | 29 | 21 |
| 87. | 296 | 100 | 44.0 | 0.0338 | 28.0 | 7.3 | .64 | 134.0 | 2,940 | 5,120 | 4,030 | 2.64 | 1.34 | 1.99 | 2,560 | 42 | 26 | 19 |
| 88. | 258 | 100 | 47.0 | 0.040 | 33.2 | 8.3 | .70 | 146.0 | 3,980 | 6,070 | 4,820 | 3.32 | 1.22 | 1.98 | 3,020 | 47 | 27 | 20 |
| 89. | 381 | 100 | 49.0 | 0.043 | 37.4 | 8.7 | .76 | 123.0 | 3,660 | 7,030 | 5,340 | 2.66 | 1.10 | 1.88 | 47.1 | 44 | 27 | 209 |
| 90. | 384 | 100 | 53.0 | 0.046 | 36.6 | 8.0 | .69 | 123.0 | 3,540 | 6,800 | 5,110 | 2.94 | 1.22 | 2.27 | 3,410 | 43 | 27 | 209 |
| 91. | 382 | 100 | 44.0 | 0.036 | 28.0 | 7.8 | .69 | 115.0 | 3,510 | 6,370 | 4,940 | 2.66 | 1.06 | 2.00 | 3,110 | 43 | 26 | 214 |
| 92. | 392 | 100 | 49.0 | 0.041 | 26.8 | 6.5 | .55 | 251.0 | 3,100 | 5,280 | 4,190 | 2.62 | 1.34 | 1.98 | 2,880 | 41 | 24 | 218 |
| 93. | 268 | 100 | 37.0 | 0.030 | 20.0 | 6.6 | .54 | 234.0 | 3,020 | 6,490 | 4,890 | 2.44 | 1.54 | 1.99 | 3,100 | 41 | 24 | 218 |

| | | | | | | | | | | | | | | | | | | | |
|----------|-----|-----|------|-------|------|-----|-----|-------|-------|-------|-------|------|------|------|-------|------|----|----|-----|
| 104..... | 293 | 100 | 44.0 | .0036 | 27.6 | 7.7 | .63 | 266.0 | 3,150 | 6,270 | 4,720 | 3,50 | 1.92 | 2.71 | 3,250 | 28.2 | 42 | 25 | 18 |
| 105..... | 266 | 100 | 41.0 | .0031 | 23.8 | 7.2 | .58 | 290.0 | 3,380 | 6,630 | 5,100 | 2.04 | 1.32 | 1.68 | 3,370 | 30.3 | 50 | 33 | 192 |
| 106..... | 267 | 100 | 39.0 | .0031 | 21.0 | 6.8 | .54 | 319.0 | 3,560 | 6,550 | 4,960 | 2.14 | 1.32 | 1.73 | 3,350 | 28.8 | 44 | 27 | 210 |
| 107..... | 285 | 100 | 40.0 | .0034 | 26.6 | 7.8 | .66 | 280.0 | 4,410 | 7,130 | 5,770 | 2.02 | 1.06 | 1.55 | 3,760 | 31.6 | 59 | 34 | 166 |
| 108..... | 375 | 100 | 35.0 | .0036 | 17.3 | 4.8 | .40 | 372.0 | 3,260 | 6,080 | 4,670 | 2.02 | 1.06 | 2.07 | 2,290 | 25.6 | 75 | 66 | 57 |
| 109..... | 318 | 100 | 38.0 | .0035 | 20.8 | 5.3 | .54 | 185.0 | 2,880 | 6,790 | 4,810 | 1.68 | 1.62 | 1.65 | 2,860 | 48.3 | 55 | 38 | 180 |
| 110..... | 311 | 100 | 38.0 | .0035 | 20.8 | 5.3 | .58 | 181.0 | 3,210 | 6,730 | 4,970 | 2.04 | 1.38 | 1.81 | 3,160 | 47.4 | 69 | 50 | 23 |
| 111..... | 200 | 100 | 42.0 | .0037 | 21.2 | 5.0 | .61 | 202.0 | 2,600 | 5,610 | 3,990 | 1.58 | 1.38 | 1.38 | 2,200 | 40.4 | 89 | 45 | 191 |
| 112..... | 317 | 100 | 40.0 | .0042 | 19.7 | 4.7 | .50 | 202.0 | 3,090 | 6,120 | 4,230 | 1.98 | 1.32 | 1.66 | 2,150 | 39.4 | 72 | 61 | 52 |
| 113..... | 202 | 100 | 40.0 | .0039 | 16.8 | 4.3 | .47 | 197.0 | 3,340 | 6,880 | 4,900 | 2.24 | 1.32 | 1.66 | 2,040 | 45.6 | 61 | 49 | 42 |
| 114..... | 316 | 100 | 36.0 | .0039 | 16.8 | 3.6 | .41 | 226.0 | 3,030 | 6,780 | 3,900 | 1.76 | 1.42 | 1.59 | 1,850 | 42.1 | 82 | 71 | 64 |
| 115..... | 304 | 100 | 38.0 | .0043 | 15.7 | 3.6 | .52 | 190.0 | 3,010 | 6,380 | 4,700 | 1.10 | 1.36 | 1.59 | 2,780 | 47.6 | 66 | 46 | 37 |
| 116..... | 309 | 100 | 38.0 | .0035 | 19.8 | 5.8 | .50 | 190.0 | 2,230 | 6,140 | 4,180 | 3.04 | 1.44 | 2.24 | 2,730 | 44.1 | 46 | 27 | 20 |
| 117..... | 307 | 100 | 34.0 | .0033 | 19.0 | 5.8 | .63 | 161.0 | 3,100 | 6,160 | 4,630 | 2.18 | 1.56 | 1.87 | 2,110 | 50.7 | 29 | 19 | 11 |
| 118..... | 304 | 100 | 44.0 | .0038 | 27.8 | 7.4 | .67 | 145.0 | 2,700 | 5,460 | 4,080 | 2.28 | 1.52 | 2.05 | 2,660 | 42.0 | 34 | 18 | 12 |
| 119..... | 303 | 100 | 45.0 | .0035 | 30.2 | 7.7 | .67 | 135.0 | 2,080 | 4,790 | 3,440 | 2.28 | 1.56 | 1.92 | 2,130 | 38.6 | 32 | 16 | 9 |
| 120..... | 308 | 100 | 35.0 | .0040 | 23.1 | 5.8 | .66 | 135.0 | 3,180 | 5,920 | 4,550 | 2.12 | 1.46 | 1.79 | 2,580 | 14.0 | 72 | 62 | 54 |
| 121..... | 337 | 80 | 41.0 | .0038 | 17.7 | 4.7 | .43 | 159.0 | 3,190 | 5,700 | 4,440 | 3.04 | 1.50 | 2.27 | 2,690 | 54.5 | 60 | 42 | 31 |
| 122..... | 305 | 100 | 52.0 | .0050 | 26.6 | 5.4 | .51 | 165.0 | 3,020 | 6,070 | 4,540 | 2.28 | 1.42 | 1.85 | 2,750 | 55.0 | 63 | 47 | 36 |
| 123..... | 332 | 79 | 30.0 | .0034 | 13.6 | 4.0 | .45 | 192.0 | 3,300 | 5,690 | 4,490 | 2.20 | 1.38 | 1.79 | 2,200 | 52.0 | 71 | 58 | 48 |
| 124..... | 333 | 80 | 33.0 | .0036 | 18.4 | 5.1 | .56 | 145.0 | 3,330 | 6,170 | 4,750 | 2.08 | 1.64 | 2.31 | 2,360 | 58.3 | 75 | 62 | 52 |
| 125..... | 334 | 80 | 31.0 | .0034 | 12.9 | 3.8 | .42 | 210.0 | 2,890 | 5,020 | 3,960 | 2.10 | 1.38 | 1.74 | 1,850 | 45.0 | 74 | 63 | 54 |
| 126..... | 335 | 80 | 32.0 | .0034 | 16.6 | 4.1 | .44 | 190.0 | 3,040 | 5,410 | 4,230 | 2.18 | 1.56 | 1.87 | 2,110 | 50.7 | 29 | 15 | 10 |
| 127..... | 377 | 100 | 49.0 | .0034 | 22.8 | 6.7 | .54 | 180.0 | 3,240 | 5,480 | 4,860 | 2.90 | 1.54 | 2.22 | 2,960 | 50.1 | 30 | 15 | 9 |
| 128..... | 310 | 100 | 38.0 | .0032 | 20.0 | 6.3 | .53 | 189.0 | 2,720 | 5,920 | 4,320 | 2.06 | 1.77 | 2.34 | 2,910 | 43.1 | 37 | 22 | 15 |
| 129..... | 219 | 100 | 39.0 | .0032 | 23.1 | 6.4 | .39 | 278.0 | 2,870 | 5,710 | 4,290 | 2.08 | 1.40 | 2.16 | 2,910 | 43.1 | 30 | 15 | 9 |
| 130..... | 294 | 100 | 39.0 | .0036 | 23.1 | 6.4 | .58 | 202.0 | 3,400 | 5,560 | 3,930 | 2.02 | 1.40 | 2.16 | 2,660 | 36.2 | 54 | 37 | 29 |
| 131..... | 290 | 100 | 41.0 | .0037 | 23.8 | 6.4 | .58 | 202.0 | 3,400 | 6,060 | 4,730 | 2.06 | 1.34 | 2.16 | 2,950 | 40.4 | 56 | 40 | 31 |
| 132..... | 222 | 75 | 32.0 | .0039 | 8.8 | 3.0 | .28 | 256.0 | 1,880 | 3,740 | 2,810 | 1.26 | 1.82 | 1.04 | 1,760 | 39.2 | 65 | 59 | 58 |
| 133..... | 444 | 80 | 32.0 | .0040 | 11.9 | 2.0 | .37 | 194.0 | 2,730 | 4,700 | 3,720 | 1.68 | 1.28 | 1.28 | 1,610 | 51.9 | 72 | 60 | 52 |
| 134..... | 475 | 100 | 29.0 | .0025 | 13.4 | 5.4 | .66 | 192.0 | 2,910 | 5,130 | 3,670 | 2.54 | 1.18 | 1.86 | 2,540 | 41.5 | 44 | 31 | 25 |
| 135..... | 476 | 100 | 35.0 | .0031 | 20.6 | 6.9 | .59 | 137.0 | 2,620 | 5,880 | 4,950 | 3.28 | 1.30 | 2.29 | 2,810 | 47.6 | 50 | 36 | 29 |
| 136..... | 477 | 100 | 32.0 | .0026 | 20.2 | 7.7 | .63 | 137.0 | 3,120 | 6,270 | 4,700 | 3.16 | 1.48 | 2.32 | 3,200 | 54.3 | 54 | 41 | 34 |
| 137..... | 478 | 100 | 32.0 | .0033 | 14.0 | 4.2 | .44 | 164.0 | 2,730 | 4,600 | 3,600 | 2.26 | 1.24 | 1.92 | 2,910 | 50.8 | 66 | 56 | 47 |
| 138..... | 473 | 100 | 33.0 | .0038 | 10.6 | 2.8 | .44 | 225.0 | 2,440 | 4,610 | 3,020 | 2.24 | 1.12 | 1.68 | 2,210 | 52.0 | 78 | 68 | 63 |
| 139..... | 479 | 100 | 34.0 | .0028 | 21.4 | 7.6 | .61 | 149.0 | 3,050 | 6,190 | 4,920 | 3.94 | 1.44 | 2.69 | 3,540 | 54.2 | 50 | 38 | 31 |
| 140..... | 229 | 100 | 35.0 | .0031 | 21.6 | 6.9 | .63 | 138.0 | 3,120 | 6,180 | 4,650 | 3.38 | 1.42 | 2.70 | 3,540 | 54.2 | 62 | 48 | 39 |
| 141..... | 480 | 100 | 37.0 | .0033 | 21.0 | 6.4 | .57 | 145.0 | 3,330 | 5,800 | 4,560 | 2.42 | 1.50 | 2.59 | 2,960 | 55.1 | 65 | 52 | 46 |
| 142..... | 482 | 100 | 36.0 | .0040 | 12.8 | 3.2 | .36 | 221.0 | 2,600 | 4,200 | 3,490 | 2.06 | 1.52 | 1.59 | 1,830 | 42.7 | 71 | 60 | 64 |
| 143..... | 474 | 100 | 35.0 | .0043 | 10.8 | 2.5 | .31 | 225.0 | 2,300 | 3,850 | 3,080 | 2.00 | 1.14 | 1.57 | 1,520 | 44.1 | 76 | 67 | 60 |
| 144..... | 542 | 100 | 46.0 | .0036 | 28.6 | 8.0 | .62 | 150.0 | 2,770 | 6,420 | 4,590 | 2.74 | 1.28 | 2.01 | 3,350 | 49.5 | 46 | 32 | 28 |
| 145..... | 543 | 100 | 37.0 | .0030 | 21.6 | 7.3 | .58 | 170.0 | 3,100 | 6,080 | 4,590 | 2.26 | .92 | 1.59 | 3,230 | 46.6 | 49 | 36 | 30 |
| 146..... | 544 | 100 | 34.0 | .0030 | 20.6 | 6.9 | .63 | 163.0 | 3,090 | 6,120 | 3,100 | 1.92 | 2.02 | 1.97 | 2,050 | 31.6 | 57 | 44 | 36 |
| 147..... | 545 | 100 | 40.0 | .0042 | 27.2 | 6.5 | .59 | 140.0 | 3,020 | 6,280 | 4,650 | 2.02 | 1.16 | 1.89 | 2,960 | 56.2 | 69 | 57 | 49 |
| 148..... | 546 | 100 | 46.0 | .0061 | 25.8 | 4.2 | .43 | 193.0 | 2,740 | 4,810 | 3,780 | 3.04 | 1.44 | 2.24 | 2,200 | 45.5 | 76 | 68 | 61 |
| 149..... | 521 | 100 | 38.0 | .0035 | 23.9 | 7.1 | .63 | 135.0 | 3,080 | 6,360 | 4,720 | 2.16 | 1.20 | 1.97 | 3,220 | 55.5 | 58 | 47 | 38 |
| 150..... | 547 | 100 | 42.0 | .0035 | 25.4 | 7.3 | .60 | 137.0 | 2,890 | 6,940 | 4,920 | 2.74 | 1.20 | 1.97 | 3,290 | 59.6 | 59 | 47 | 39 |
| 151..... | 548 | 100 | 39.0 | .0039 | 15.0 | 3.8 | .38 | 212.0 | 2,630 | 3,720 | 3,180 | 1.84 | .92 | 1.38 | 1,860 | 30.4 | 70 | 61 | 54 |

1 Commercial.

TABLE 7.—*Quality tests—white spruce—Continued.*

| Grinder run No. | Paper machine run No. | Ground wood in total furnish. | Weight per ream. | Thickness. | Mullen test. | | | | Schopper tests. | | | | | | Tintometer indications. | | | | |
|-----------------|-----------------------|-------------------------------|------------------|------------|--------------|-----------------------------|------------|--|------------------|-------------|----------|----------|------------|-------------|-------------------------|--------|--------|--------|----------|
| | | | | | Total. | Per .001 inch of thickness. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | | Stretch. | | | Red. | Green. | Blue. | Black. | |
| | | | | | | | | | Crosswise. | Lengthwise. | Average. | Per ct. | Crosswise. | Lengthwise. | | | | | Average. | Per ct. | Grams. | Breaking weight per square millimeter, sectional | Breaking length per ton. |
| | | | Lbs. | Inch. | Points. | Points. | Points. | Point. | Meters. | Meters. | Meters. | Per ct. | Per ct. | Per ct. | Parts. | Parts. | Parts. | Parts. | |
| 212 | 522 | 100 | 44.0 | 0.0046 | 17.6 | 3.8 | 3.8 | 203.0 | 2,550 | 4,230 | 3,390 | 2.22 | 1.04 | 1.63 | 77 | 69 | 61 | 93 | |
| 213 | 623 | 80 | 34.0 | 0.0036 | 15.5 | 4.3 | 4.3 | 272.0 | 3,110 | 5,640 | 4,380 | 3.10 | 1.38 | 2.24 | 80 | 72 | 65 | 83 | |
| 214 | 622 | 80 | 38.0 | 0.0040 | 16.4 | 4.0 | 4.0 | 226.0 | 2,530 | 4,950 | 3,740 | 2.08 | 1.36 | 2.02 | 80 | 71 | 65 | 84 | |
| 215 | 672 | 80 | 36.0 | 0.0037 | 16.1 | 4.4 | 4.4 | 188.0 | 3,140 | 6,140 | 4,640 | 1.96 | 1.16 | 1.56 | 78 | 68 | 64 | 90 | |
| 216 | 652 | 80 | 37.0 | 0.0040 | 16.4 | 4.0 | 4.0 | 221.0 | 3,060 | 5,390 | 4,220 | 2.86 | 1.06 | 1.96 | 74 | 67 | 62 | 97 | |
| 217 | 624 | 80 | 36.0 | 0.0040 | 14.8 | 3.7 | 3.7 | 259.0 | 2,610 | 4,960 | 2,780 | 2.96 | 1.40 | 2.18 | 78 | 71 | 63 | 88 | |
| 218 | 625 | 80 | 41.0 | 0.0045 | 13.4 | 3.0 | 3.0 | 202.0 | 2,350 | 4,250 | 3,300 | 2.22 | 1.22 | 1.72 | 76 | 70 | 64 | 90 | |
| 219 | 666 | 80 | 44.0 | 0.0040 | 21.0 | 5.3 | 5.3 | 394.0 | 3,280 | 5,580 | 4,430 | 2.28 | 1.14 | 2.01 | 71 | 63 | 56 | 110 | |
| 220 | 662 | 80 | 34.0 | 0.0031 | 16.8 | 5.5 | 5.5 | 290.0 | 3,380 | 6,660 | 5,020 | 2.58 | 1.44 | 2.01 | 76 | 67 | 61 | 96 | |
| 221 | 627 | 80 | 33.0 | 0.0034 | 17.2 | 5.1 | 5.1 | 52.0 | 2,870 | 6,110 | 4,490 | 2.58 | 1.24 | 1.91 | 70 | 61 | 57 | 112 | |
| 222 | 660 | 80 | 37.0 | 0.0036 | 19.4 | 5.4 | 5.4 | 414.0 | 3,370 | 6,730 | 5,050 | 1.86 | 1.30 | 1.58 | 73 | 64 | 58 | 105 | |
| 223 | 661 | 80 | 37.0 | 0.0035 | 20.0 | 5.7 | 5.7 | 330.0 | 3,580 | 6,660 | 5,120 | 2.30 | 1.30 | 1.80 | 76 | 68 | 60 | 96 | |
| 224 | 626 | 80 | 40.0 | 0.0036 | 20.6 | 5.7 | 5.7 | 52.0 | 3,180 | 6,270 | 4,720 | 2.72 | 1.30 | 2.01 | 77 | 66 | 62 | 95 | |
| 225 | 657 | 84 | 35.0 | 0.0038 | 18.3 | 2.7 | 2.7 | 29.0 | 2,650 | 4,690 | 3,670 | 1.54 | 1.02 | 1.28 | 77 | 66 | 60 | 95 | |
| 226 | 633 | 80 | 40.0 | 0.0042 | 18.7 | 4.4 | 4.4 | 274.0 | 3,030 | 5,140 | 4,080 | 1.98 | .84 | 1.41 | 79 | 68 | 60 | 95 | |
| 227 | 648 | 80 | 36.0 | 0.0040 | 15.8 | 4.0 | 4.0 | 336.0 | 3,230 | 6,380 | 4,900 | 2.22 | 1.10 | 1.66 | 75 | 70 | 63 | 92 | |
| 228 | 644 | 80 | 36.0 | 0.0041 | 13.6 | 3.4 | 3.4 | 253.0 | 3,000 | 5,270 | 4,140 | 2.16 | .98 | 1.57 | 76 | 70 | 63 | 91 | |
| 229 | 671 | 80 | 37.0 | 0.0041 | 10.5 | 2.4 | 2.4 | 38.0 | 2,460 | 4,500 | 3,480 | 1.88 | .88 | 1.13 | 81 | 71 | 63 | 85 | |
| 230 | 639 | 80 | 35.0 | 0.0039 | 13.9 | 3.5 | 3.5 | 40.0 | 2,870 | 5,800 | 4,340 | 1.84 | 1.04 | 1.44 | 77 | 69 | 63 | 82 | |
| 231 | 679 | 80 | 33.0 | 0.0038 | 13.0 | 3.5 | 3.5 | 214.0 | 2,980 | 5,800 | 4,390 | 1.84 | .94 | 1.39 | 79 | 69 | 63 | 89 | |
| 232 | 608 | 80 | 40.0 | 0.0046 | 14.8 | 3.2 | 3.2 | 239.0 | 2,810 | 5,210 | 4,010 | 1.82 | .92 | 1.37 | 79 | 69 | 63 | 89 | |
| 233 | 680 | 80 | 39.0 | 0.0045 | 14.6 | 3.0 | 3.0 | 207.0 | 3,060 | 5,350 | 4,200 | 1.76 | .82 | 1.29 | 80 | 70 | 64 | 86 | |
| 234 | 705 | 100 | 40.0 | 0.0036 | 18.0 | 5.0 | 5.0 | 130.0 | 2,420 | 5,680 | 4,050 | 1.48 | 1.06 | 1.27 | 80 | 70 | 64 | 86 | |
| 235 | 704 | 100 | 38.0 | 0.0035 | 18.4 | 5.3 | 5.3 | 119.0 | 2,160 | 5,710 | 3,940 | 1.10 | 1.04 | 1.07 | 47 | 32 | 27 | 194 | |
| 236 | 703 | 100 | 38.0 | 0.0034 | 19.8 | 5.9 | 5.9 | 111.0 | 2,350 | 6,180 | 4,260 | 1.28 | 1.14 | 1.21 | 50 | 35 | 30 | 185 | |
| 237 | 697 | 100 | 45.0 | 0.0049 | 17.4 | 3.6 | 3.6 | 127.0 | 2,280 | 4,910 | 3,600 | 1.28 | 1.00 | 1.21 | 55 | 39 | 32 | 173 | |
| 238 | 733 | 80 | 39.0 | 0.0046 | 8.6 | 1.9 | 1.9 | 26.0 | 188.0 | 2,620 | 4,180 | 3,120 | 1.42 | 1.06 | 1.21 | 65 | 52 | 45 | 138 |
| 239 | 697 | 100 | 39.0 | 0.0033 | 24.0 | 7.3 | 7.3 | 62.0 | 104.0 | 3,020 | 7,540 | 5,580 | 2.54 | 1.42 | 1.06 | 77 | 69 | 61 | 93 |
| 240 | 707 | 100 | 34.0 | 0.0031 | 18.6 | 6.0 | 6.0 | 55.0 | 103.0 | 2,630 | 6,580 | 4,900 | 1.42 | 1.10 | 1.26 | 52 | 37 | 30 | 181 |
| 241 | 698 | 100 | 43.0 | 0.0041 | 22.5 | 5.5 | 5.5 | 52.0 | 112.0 | 2,890 | 5,800 | 4,340 | 1.88 | 1.00 | 1.44 | 50 | 37 | 31 | 182 |
| 242 | 702 | 100 | 46.0 | 0.0041 | 27.0 | 6.6 | 6.6 | 58.0 | 98.0 | 3,190 | 6,170 | 4,680 | 3.22 | 1.38 | 2.30 | 59 | 42 | 36 | 163 |

| | | | | | | | | | | | | | | | | | | | | |
|----------|-----|-----|------|-------|------|-----|-----|-------|-------|-------|-------|------|------|------|-------|------|----|----|----|-----|
| 274..... | 699 | 100 | 41.0 | .0044 | 17.8 | 4.1 | .43 | 128.0 | 2,850 | 5,250 | 4,040 | 1.42 | .88 | 1.15 | 2,140 | 73.3 | 64 | 53 | 46 | 137 |
| 275..... | 684 | 100 | 46.0 | .0057 | 9.2 | 1.6 | .20 | 265.0 | 2,320 | 3,060 | 2,700 | 1.20 | .82 | 1.01 | 1,220 | 51.0 | 76 | 68 | 61 | 95 |
| 276..... | 710 | 80 | 33.0 | .0042 | 9.6 | 2.3 | .29 | 296.0 | 2,340 | 4,860 | 3,600 | 1.52 | .94 | 1.23 | 1,540 | 41.9 | 84 | 74 | 67 | 75 |
| 277..... | 685 | 80 | 37.0 | .0048 | 9.3 | 2.0 | .30 | 241.0 | 2,320 | 3,930 | 3,120 | 1.52 | 1.02 | 1.27 | 1,320 | 43.2 | 73 | 70 | 62 | 95 |
| 278..... | 678 | 80 | 44.0 | .0054 | 12.2 | 2.2 | .28 | 186.0 | 2,460 | 4,680 | 3,570 | 1.38 | .82 | 1.10 | 1,510 | 68.7 | 81 | 71 | 64 | 85 |
| 279..... | 676 | 80 | 37.0 | .0051 | 7.2 | 1.4 | .19 | 242.0 | 1,820 | 3,360 | 2,590 | 1.20 | .70 | .95 | 950 | 56.3 | 81 | 71 | 64 | 84 |
| 280..... | 714 | 80 | 38.0 | .0046 | 12.7 | 2.7 | .33 | 251.0 | 1,260 | 4,860 | 3,560 | 1.96 | 1.00 | 1.48 | 1,640 | 43.0 | 81 | 72 | 66 | 81 |
| 281..... | 635 | 80 | 38.0 | .0045 | 13.8 | 3.1 | .36 | 236.0 | 2,960 | 4,950 | 3,960 | 2.36 | .98 | 1.67 | 1,800 | 46.6 | 78 | 72 | 67 | 83 |
| 282..... | 670 | 80 | 38.0 | .0044 | 12.7 | 2.9 | .33 | 312.0 | 2,810 | 5,410 | 4,110 | 2.00 | 1.02 | 1.51 | 1,900 | 39.9 | 75 | 66 | 62 | 97 |

† Pulp for runs 257 to 282, inclusive, were made on a coarse-grit stone.

TABLE 8.—Grinder runs on balsam fir.¹

| Run No. | Preliminary treatment of wood. | Stone. | | No. of pockets used. | Pressure on 14-inch cylinder. | Pressure per square inch of pocket area. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton bone-dry pulp in 24 hours. | Solid rossed wood ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | | Bone-dry pulp per 100 cubic feet solid rossed wood. | Efficiency of conversion. | Screenings per 100 cubic feet solid rossed wood bone-dry. | Average temperature of grinding. | Horsepower divided by pressure \times speed. |
|---------|--------------------------------|--|---|----------------------|-------------------------------|--|-------------------------|-------------------|--------------------------------|--------------------------------|----------------------------|---|---------------------------------------|--------------------------------------|---------------------------|-------------------|-------|---|---------------------------|---|----------------------------------|--|
| | | Kind of burr. | Surface. | | | | | | | | | | | | | Lbs. per sq. in. | Lbs. | | | | | |
| 1 | | Straight, cut 3 to 12 to inch. | Same as No. 7 tarack. | 3 | 20 | 8.2 | 175 | 2,428 | 189.0 | 228 | 1,345 | 140.5 | 157.0 | 23.80 | 6 | 27.83 | 1,710 | 71.9 | 9.35 | 162.1 | 0.00949 | |
| 2 | | do. | Same surface. | 3 | 40 | 16.4 | 175 | 2,428 | 323.0 | 372 | 3,225 | 100.2 | 360.0 | 23.80 | 5 | 27.83 | 1,792 | 75.4 | 19.88 | 155.0 | .00811 | |
| 3 | | do. | do. | 3 | 60 | 24.65 | 175 | 2,428 | 470.0 | 541 | 5,695 | 82.6 | 661.0 | 23.80 | 5 | 27.83 | 1,720 | 72.3 | 41.25 | 150.0 | .00785 | |
| 4 | | Diamond point, cut 10 to inch. | Stone dressed. | 3 | 20 | 8.2 | 175 | 2,428 | 161.6 | 178 | | | | 23.08 | 5 | 34.76 | | 76.6 | | 137.8 | | |
| 5 | | do. | Same surface. | 3 | 40 | 16.4 | 175 | 2,428 | 311.0 | 344 | 1,749 | 178.0 | | | 5 | 34.76 | 1,770 | 81.3 | 8.65 | 137.8 | .00781 | |
| 6 | | do. | do. | 3 | 60 | 24.65 | 175 | 2,428 | 424.0 | 495 | 3,485 | 121.3 | 371.5 | 23.08 | 5 | 34.76 | 1,877 | 81.3 | 13.50 | 157.5 | .00708 | |
| 7 | Steamed. | Straight, cut 3 to 12 to inch; spiral, cut 12 to inch. | Same as poplar No. 1. | 3 | 40 | 16.4 | 200 | 2,762 | 336.0 | 399 | 2,710 | 123.9 | 354.5 | 21.07 | 6 | 59.45 | 1,530 | 72.5 | 23.20 | 146.7 | .00741 | |
| 8 | | do. | Same as for No. 925 spruce. | 3 | 20 | 8.2 | 175 | 2,417 | 187.0 | 210 | .835 | 224.0 | 86.8 | 21.44 | 4 | 58.45 | 1,923 | 89.6 | 10.79 | 178.8 | .00945 | |
| 9 | | do. | Same surface. | 3 | 40 | 16.4 | 175 | 2,417 | 336.0 | 378 | 2,525 | 133.0 | 260.0 | 21.44 | 4 | 58.45 | 1,943 | 90.6 | 11.24 | 158.1 | .00849 | |
| 10 | | do. | do. | 3 | 60 | 24.65 | 175 | 2,417 | 446.0 | 517 | 4,130 | 108.0 | 422.5 | 21.44 | 4 | 58.45 | 1,956 | 91.1 | 19.12 | 146.9 | .00750 | |
| 11 | | do. | do. | 3 | 20 | 8.2 | 225 | 3,107 | 230.0 | 278 | 2,946 | 243.5 | 96.2 | 21.44 | 5 | 58.45 | 1,968 | 91.6 | 10.73 | 182.8 | .00904 | |
| 12 | | do. | do. | 3 | 40 | 16.4 | 225 | 3,107 | 396.0 | 451 | 2,390 | 165.7 | 240.4 | 21.44 | 5 | 58.45 | 1,988 | 92.6 | 9.65 | 171.8 | .00777 | |
| 13 | | do. | do. | 3 | 60 | 24.65 | 225 | 3,107 | 595.0 | 660 | 5,400 | 110.1 | 540.0 | 21.44 | 4 | 58.45 | 2,000 | 93.2 | 18.17 | 145.8 | .00776 | |
| 14 | | do. | Same as for poplar No. 2. | 3 | 30 | 12.3 | 225 | 3,085 | 322.0 | 358 | 2,080 | 134.8 | 216.0 | 22.01 | 4 | 49.88 | 1,922 | 87.4 | 6.88 | 178.5 | .00848 | |
| 15 | Boiled. | Straight, cut 8 to 12 to inch. | Same as No. 15 Montana lodge-pole. | 2 | 40 | 16.4 | 225 | 3,080 | 240.0 | 292 | 1,155 | 208.0 | 140.9 | 21.66 | 5 | 51.23 | 1,640 | 75.6 | 21.45 | 143.9 | .00475 | |
| 16 | do. | do. | Same surface. | 2 | 60 | 24.65 | 225 | 3,080 | 317.0 | 383 | 1,830 | 173.2 | 212.0 | 21.66 | 5 | 51.23 | 1,728 | 79.6 | 25.40 | 138.0 | .00417 | |
| 17 | do. | do. | do. | 2 | 80 | 32.8 | 225 | 3,080 | 374.0 | 440 | 2,227 | 167.8 | 264.0 | 21.66 | 5 | 51.23 | 1,690 | 78.0 | 22.70 | 129.6 | .00370 | |
| 18 | | Straight, cut 3 to 12 to inch; spiral, cut 12 to inch. | Same as for No. 15 western yellow pine. | 3 | 60 | 24.65 | 100 | 1,366 | 275.0 | 306 | 2,242 | 122.8 | 264.0 | 21.20 | 5 | 48.75 | 1,698 | 80.0 | 15.43 | 97.0 | .00816 | |
| 19 | | do. | Same surface. | 3 | 60 | 24.65 | 150 | 2,049 | 400.0 | 449 | 3,320 | 120.4 | 354.0 | 21.20 | 4 | 48.75 | 1,876 | 88.5 | 19.06 | 129.5 | .00790 | |
| 20 | | do. | do. | 3 | 60 | 24.65 | 200 | 2,732 | 496.0 | 553 | 3,880 | 128.0 | 428.0 | 21.20 | 5 | 48.75 | 1,814 | 85.5 | 15.80 | 139.6 | .00736 | |

| | | | | | | | | | | | | | | | | | | | | |
|----|----------|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| 21 | ..... | Straight, cut 2 to 12 to inch, spiral, cut 12 to inch. | 3 | 60 | 24.65 | 250 | 3,415 | 551.0 | 630 | 4.325 | 127.6 | 463.0 | 21.20 | 52 | 48.75 | 1,870 | 88.1 | 19.20 | 147.6 | .00654 |
| 22 | ..... | Spiral, cut 8 to 10 to inch, straight, cut 10 to inch. | 3 | 40 | 16.4 | 225 | 3,069 | 481.0 | 543 | 5.330 | 90.4 | 546.0 | 20.75 | 47 | 60.40 | 1,950 | 94.1 | 8.45 | 150.4 | .00955 |
| 23 | ..... | Same as for No. 27 western yellow pine. | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 24 | ..... | Spiral, cut 8 to 10 to inch, straight, cut 10 to inch. | 2 | 60 | 16.4 | 175 | 2,387 | 333.0 | 372 | 3.225 | 103.1 | 338.0 | 20.20 | 52 | 61.66 | 1,910 | 94.5 | 18.60 | 148.0 | .00850 |
| 25 | Steamed. | Same as No. 4 Fungelmann spruce. | 2 | 20 | 8.2 | 225 | 3,048 | 137.0 | 171 | .953 | 144.0 | 113.0 | 19.92 | 52 | 61.08 | 1,680 | 84.4 | 13.40 | 150.0 | .00548 |
| 26 | do. | Same surface. | 2 | 40 | 16.4 | 225 | 3,048 | 246.0 | 286 | 2.302 | 106.8 | 270.0 | 19.92 | 52 | 61.08 | 1,710 | 85.9 | 17.30 | 133.0 | .00491 |
| 27 | do. | do. | 2 | 60 | 24.65 | 225 | 3,048 | 311.0 | 355 | 3.105 | 100.0 | 374.0 | 19.92 | 52 | 61.08 | 1,660 | 83.3 | 20.30 | 136.0 | .00414 |
| 28 | do. | do. | 2 | 80 | 32.8 | 225 | 3,048 | 371.0 | 414 | 3.755 | 98.9 | 441.0 | 19.92 | 52 | 61.08 | 1,700 | 83.3 | 30.60 | 134.0 | .00371 |
| 29 | do. | do. | 2 | 100 | 41.0 | 225 | 3,048 | 413.0 | 491 | 4.050 | 102.0 | 479.0 | 19.92 | 52 | 61.08 | 1,696 | 85.0 | 27.30 | 136.0 | .00330 |

¹ For conditions of cooking see Table 32.² See Runs on mixed woods (commercial).

TABLE 9.—Grinder runs on red fir.¹

| Run No. | Stone. | | Number of pockets used. | Pressure on 14-inch cylinder. | Pressure per square inch of pocket area. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton bone-dry pulp in 24 hours. | Solid ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | Bone-dry pulp per 100 cubic feet solid wood. | Efficiency of conversion. | Screenings per 100 cubic feet solid rossed wood bone-dry. | Average temperature of grinding. | Horsepower divided by pressure \times speed. |
|---------|--------------------------------|--|-------------------------|-------------------------------|--|-------------------------|-------------------|--------------------------------|--------------------------------|----------------------------|---|---------------------------|--------------------------------------|---------------------------|-------------------|--|---------------------------|---|----------------------------------|--|
| | Preliminary treatment of wood. | Kind of burr. | | | | | | | | | | | | | | | | | | |
| | | | | Lbs. per sq. in. | Lbs. | | Fl. per minute. | | | Tons. | | Cu. ft. | Lbs. | Inches. | P. ct. | Lbs. | P. ct. | Lbs. | ° F. | |
| 1 | | Straight, cut 3 to inch; spiral, cut 12 to inch. | 3 | 50 | 20.5 | 200 | 2,775 | 420.0 | 489 | 6.450 | 65.2 | 672.0 | 21.93 | (²) | 16.98 | 1,920 | 87.6 | 10.94 | 133.0 | 0.00739 |
| 2 | Steamed |do..... | 3 | 40 | 16.4 | 200 | 2,762 | 288.5 | 370 | 2.299 | 125.7 | 297.0 | 23.76 | (²) | 15.63 | 1,547 | 65.1 | 17.76 | 166.3 | .00036 |
| 3 | |do..... | 3 | 30 | 12.3 | 225 | 3,085 | 325.0 | 374 | Qualitative run. | | | | | | | | | | .00856 |
| 4 | |do..... | 3 | 30 | 12.3 | 225 | 3,085 | 304.0 | 370 | 1.680 | 181.0 | 169.0 | 24.35 | (²) | 11.17 | 1,988 | 81.6 | 12.31 | 178.0 | .00800 |
| 5 | |do..... | 3 | 60 | 24.65 | 225 | 3,085 | 521.0 | 574 | 2.565 | 203.5 | 302.0 | 24.47 | (²) | 22.40 | 1,700 | 69.5 | 9.83 | 176.2 | .00685 |
| 6 | |do..... | 3 | 60 | 24.65 | 100 | 1,366 | 244.0 | 282 | 1.161 | 210.0 | 128.0 | 21.85 | (²) | 20.13 | 1,815 | 83.0 | 19.10 | 157.2 | .00725 |
| 7 | |do..... | 3 | 60 | 24.65 | 150 | 2,049 | 360.0 | 434 | 1.088 | 337.0 | 136.6 | 21.85 | (²) | 20.13 | 1,590 | 72.7 | 12.38 | 175.3 | .00724 |
| 8 | |do..... | 3 | 60 | 24.65 | 200 | 2,732 | 425.0 | 485 | 1.379 | 308.0 | 162.0 | 21.85 | (²) | 20.13 | 1,698 | 77.6 | 11.10 | 178.2 | .00630 |
| 9 | |do..... | 3 | 60 | 24.65 | 250 | 3,415 | 566.0 | 647 | 2.188 | 238.5 | 312.0 | 21.85 | (²) | 20.13 | 1,400 | 64.0 | 9.60 | 181.0 | .00673 |
| 10 | |do..... | 2 | 20 | 8.2 | 225 | 3,073 | 153.4 | 177 | .492 | 312.0 | 52.5 | 21.02 | (²) | 22.72 | 1,872 | 89.0 | 6.40 | 154.1 | .00609 |
| 11 | |do..... | 2 | 40 | 16.4 | 225 | 3,073 | 246.0 | 303 | 1.165 | 211.0 | 130.0 | 21.02 | (²) | 22.72 | 1,790 | 85.1 | 7.98 | 166.3 | .00489 |
| 12 | |do..... | 2 | 60 | 24.65 | 225 | 3,073 | 376.0 | 450 | 1.737 | 216.5 | 212.0 | 21.02 | (²) | 22.72 | 1,638 | 77.8 | 9.90 | 166.2 | .00496 |
| 13 | |do..... | 2 | 80 | 32.8 | 225 | 3,073 | 459.0 | 543 | 2.500 | 183.4 | 265.0 | 21.02 | (²) | 22.72 | 1,890 | 89.9 | 8.51 | 156.5 | .00455 |
| 14 | |do..... | 2 | 100 | 41.0 | 225 | 3,073 | 475.0 | 576 | 3.275 | 145.0 | 362.0 | 21.02 | (²) | 22.72 | 1,810 | 86.0 | 16.72 | 155.7 | .00377 |
| 15 | | Spiral, cut 8 to inch; straight, cut 10 to inch. | 2 | 40 | 16.4 | 225 | 3,069 | 238.0 | 286 | 1.627 | 146.3 | 165.0 | 21.60 | (²) | 28.87 | 1,970 | 91.2 | 7.76 | 158.0 | .00472 |

| | | | | | | | | | | | | | | | | | | | | |
|----|-----|--|---|-----|-------|-----|-------|-------|-----|-------|-------|-------|-------|-----|-------|-------|------|-------|-------|--------|
| 16 | do. | Same surface. | 2 | 60 | 24.65 | 225 | 3,069 | 352.0 | 428 | 2,806 | 125.2 | 282.0 | 21.60 | (2) | 28.87 | 1,998 | 92.4 | 9.70 | 157.7 | .00465 |
| 17 | do. | do. | 2 | 80 | 32.8 | 225 | 3,099 | 452.0 | 527 | 4,570 | 101.1 | 446.0 | 21.60 | (2) | 28.87 | 2,043 | 94.6 | 11.26 | 149.0 | .00459 |
| 18 | do. | do. | 2 | 100 | 41.0 | 225 | 3,099 | 500.0 | 632 | 5,540 | 101.0 | 540.0 | 21.60 | (2) | 28.87 | 2,050 | 94.9 | 10.37 | 151.7 | .00445 |
| 19 | do. | Same as for No. 26 California lodgepole. | 2 | 80 | 32.8 | 225 | 3,069 | 483.0 | 580 | 5,710 | 84.6 | 571.0 | 21.59 | (2) | 26.50 | 2,000 | 92.7 | 12.60 | 158.0 | .00479 |

² Split wood.¹ For conditions of cooking see Table 32.

TABLE 10.—Grinder runs on white fir.¹

| Run No. | Preliminary treatment of wood. | Stone. | | Number of pockets used. | Pressure on 14-inch cylinder. | Pressure per square inch. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton bone-dry pulp in 24 hours. | Solid ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | Bone-dry pulp per 100 cubic feet solid tressed wood. | Efficiency of conversion. | Screenings per 100 cubic feet solid tressed wood bone-dry. | Average temperature of grinding. | Horsepower divided by pressure \times speed. |
|---------|--------------------------------|--|--|-------------------------|-------------------------------|---------------------------|-------------------------|-------------------|--------------------------------|--------------------------------|----------------------------|---|---------------------------|--------------------------------------|---------------------------|-------------------|--|---------------------------|--|----------------------------------|--|
| | | Kind of burr. | Surface. | | Lbs. per sq. in. | Lbs. | ft. per minute. | | | | Tons. | | | | | | | | | | |
| 1 | | Spiral, cut 8 to 10 inch; straight, cut 10 to 12 inch. | Same as No. 3, Engelmann spruce, Colo. | 2 | 40 | 16.4 | 225 | 3,069 | 306 | 342 | 132.0 | 245 | 370 | 19.47 | (2) | 64.80 | 1,892 | 97.2 | 17.3 | 155 | 0.00607 |
| 2 | | do. | Same surface. | 2 | 60 | 24.65 | 225 | 3,069 | 355 | 442 | 107.7 | 370 | 370 | 19.47 | (2) | 64.80 | 1,930 | 99.1 | 21.3 | 150 | .00509 |
| 3 | | do. | do. | 2 | 80 | 32.8 | 225 | 3,069 | 409 | 559 | 88.5 | 529 | 370 | 19.47 | (2) | 64.80 | 2,000 | 102.8 | 22.6 | 142 | .00465 |
| 4 | | do. | do. | 2 | 60 | 24.65 | 100 | 1,355 | 276 | 318 | 86.8 | 296 | 22.17 | (2) | (3) | 48.76 | 2,150 | 97.0 | 10.7 | 146 | .00825 |
| 5 | | do. | do. | 3 | 60 | 24.65 | 150 | 2,033 | 302 | 427 | 90.7 | 394 | 22.17 | (2) | (3) | 48.76 | 2,025 | 91.5 | 12.6 | 150 | .03722 |
| 6 | | do. | do. | 3 | 60 | 24.65 | 200 | 2,710 | 503 | 609 | 85.5 | 602 | 22.17 | (2) | (3) | 48.76 | 1,775 | 80.1 | 9.4 | 135 | .00732 |
| 7 | | do. | do. | 3 | 60 | 24.65 | 250 | 3,388 | 556 | 661 | 6.650 | 582 | 22.17 | (2) | (3) | 48.76 | 2,280 | 102.9 | 11.5 | 136 | .00665 |
| 8 | | do. | do. | 2 | 40 | 16.4 | 175 | 2,372 | 223 | 268 | 115.9 | 189 | 21.42 | (2) | (2) | 45.50 | 2,030 | 94.7 | 13.6 | 151 | .00574 |
| 9 | | do. | do. | 2 | 60 | 24.65 | 175 | 2,372 | 201 | 345 | 101.0 | 302 | 21.42 | (2) | (2) | 45.50 | 1,910 | 89.1 | 15.2 | 155 | .00497 |
| 10 | | do. | do. | 2 | 80 | 32.8 | 175 | 2,372 | 374 | 440 | 93.1 | 383 | 21.42 | (2) | (2) | 45.50 | 2,100 | 98.0 | 17.2 | 148 | .00480 |
| 11 | | do. | do. | 2 | 100 | 41.0 | 175 | 2,372 | 407 | 492 | 4.775 | 477 | 21.42 | (2) | (2) | 45.50 | 2,000 | 93.2 | 20.2 | 143 | .00419 |
| 12 | | do. | do. | 2 | 40 | 16.4 | 175 | 2,372 | 214 | 260 | 109.0 | 194 | 22.76 | (2) | (2) | 50.88 | 2,120 | 93.2 | 8.5 | 150 | .00627 |
| 13 | | do. | do. | 2 | 60 | 24.65 | 175 | 2,372 | 313 | 350 | 89.7 | 274 | 22.76 | (2) | (2) | 50.88 | 2,110 | 92.9 | 16.2 | 154 | .00535 |
| 14 | | do. | do. | 2 | 80 | 32.8 | 175 | 2,372 | 390 | 449 | 4.770 | 438 | 22.76 | (2) | (2) | 50.88 | 2,040 | 89.7 | 9.6 | 145 | .00501 |
| 15 | | do. | do. | 2 | 100 | 41.0 | 175 | 2,372 | 413 | 516 | 5.250 | 500 | 22.76 | (2) | (2) | 50.88 | 2,100 | 92.4 | 14.6 | 142 | .00455 |
| 16 | | Spiral cut 8 to 10 inch | Stone dressed | 3 | 40 | 16.4 | 175 | 2,372 | 218 | 274 | (3) | (3) | (3) | (2) | (2) | 49.97 | (3) | (3) | (3) | 133 | .00560 |
| 17 | | Diamond point, 6 to 10 inch. | do. | 2 | 40 | 16.4 | 175 | 2,372 | 232 | 280 | 107.2 | 229 | 20.82 | (2) | (2) | 49.97 | 1,888 | 90.5 | 5.3 | 147 | .00596 |
| 18 | | do. | do. | 2 | 60 | 24.65 | 175 | 2,372 | 325 | 365 | 100.0 | 364 | 20.82 | (2) | (2) | 49.97 | 1,790 | 85.9 | 12.6 | 151 | .00555 |
| 19 | | do. | do. | 2 | 80 | 32.8 | 175 | 2,372 | 395 | 465 | 4.630 | 476 | 20.82 | (2) | (2) | 49.97 | 1,945 | 93.4 | 14.6 | 151 | .00508 |
| 20 | | do. | do. | 2 | 100 | 41.0 | 175 | 2,372 | 467 | 558 | 6.210 | 631 | 20.82 | (2) | (2) | 49.97 | 1,825 | 87.5 | 15.5 | 141 | .00480 |
| 21 | Steamed | do. | do. | 2 | 40 | 16.4 | 200 | 2,710 | 231 | 271 | 126.0 | 238 | 20.82 | (2) | (2) | 49.97 | 1,620 | 77.7 | 30.0 | 143 | .00520 |
| 22 | do. | do. | do. | 2 | 60 | 24.65 | 200 | 2,794 | 320 | 364 | 2.800 | 375 | 20.82 | (2) | (2) | 49.97 | 1,490 | 71.5 | 21.5 | 144 | .00465 |
| 23 | do. | do. | do. | 2 | 80 | 32.8 | 200 | 2,835 | 395 | 449 | 4.005 | 488 | 20.82 | (2) | (2) | 49.97 | 1,645 | 79.1 | 27.6 | 139 | .00425 |
| 24 | do. | do. | do. | 2 | 100 | 41.0 | 210 | 2,845 | 408 | 555 | 4.815 | 617 | 20.82 | (2) | (2) | 49.97 | 1,500 | 74.9 | 28.8 | 134 | .00401 |
| 25 | do. | do. | do. | 2 | 60 | 24.65 | 180 | 2,682 | 322 | 371 | 95.5 | 388 | 20.82 | (2) | (2) | 49.97 | 1,740 | 83.5 | 25.0 | 134 | .00486 |
| 26 | do. | do. | do. | 3 | 60 | 24.65 | 198 | 2,561 | 320 | 372 | 89.2 | 395 | 20.82 | (2) | (2) | 49.97 | 1,813 | 87.0 | 27.2 | 137 | .00506 |

| | | | | | | | | | | | | | | | | | | | | |
|----|-----|-----|---|----|-------|-----|-------|-----|-----|-------|-------|-----|-------|-----|-------|-------|------|------|-----|--------|
| 27 | do. | do. | 2 | 60 | 24.65 | 100 | 1,355 | 195 | 226 | 1,725 | 113.0 | 179 | 21.85 | (2) | 38.90 | 1,930 | 88.3 | 10.0 | 149 | .00584 |
| 28 | do. | do. | 2 | 60 | 24.65 | 150 | 2,033 | 280 | 326 | 2,605 | 107.3 | 249 | 21.85 | (2) | 38.90 | 2,093 | 95.6 | 13.3 | 158 | .00559 |
| 29 | do. | do. | 2 | 60 | 24.65 | 200 | 2,710 | 381 | 425 | 3,930 | 97.0 | 387 | 21.85 | (2) | 38.90 | 2,030 | 92.8 | 13.4 | 158 | .00570 |
| 30 | do. | do. | 2 | 60 | 24.65 | 250 | 3,388 | 449 | 500 | 4,755 | 94.5 | 445 | 21.85 | (2) | 38.90 | 2,140 | 97.9 | 6.5 | 144 | .00536 |
| 31 | do. | do. | 2 | 60 | 24.65 | 100 | 1,355 | 196 | 231 | 1,750 | 112.0 | 171 | 22.18 | (2) | 34.15 | 2,040 | 92.0 | 15.7 | 150 | .00586 |
| 32 | do. | do. | 2 | 60 | 24.65 | 150 | 2,033 | 280 | 329 | 2,998 | 122.0 | 225 | 22.18 | (2) | 34.15 | 2,040 | 92.0 | 14.0 | 160 | .00559 |
| 33 | do. | do. | 2 | 60 | 24.65 | 200 | 2,710 | 400 | 459 | 3,500 | 114.2 | 338 | 22.18 | (2) | 34.15 | 2,075 | 93.5 | 27.0 | 164 | .00599 |
| 34 | do. | do. | 2 | 60 | 24.65 | 250 | 3,388 | 455 | 509 | 3,945 | 115.0 | 393 | 22.18 | (2) | 34.15 | 2,005 | 90.5 | 12.9 | 158 | .00544 |
| 35 | do. | do. | 3 | 45 | 18.5 | 225 | 3,020 | 384 | 477 | 4,775 | 80.4 | 498 | 20.80 | (2) | 20.58 | 1,920 | 92.2 | 16.4 | 182 | .00887 |

1 For conditions of cooking see Table 32.

2 Split wood.

3 No production data.

Spiral, cut 8 to
inch; straight,
cut 10 to inch.

TABLE 11.—Grinder runs on Alpine fir.¹

| Run No. | Preliminary treatment of wood. | Stone. | | Number of pockets used. | Pressure on 14-inch cylinder. | Pressure per square inch. | Revolutions per minute. | Peripheral speed. | | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton bone-dry pulp in 24 hours. | Solid ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | | Bone-dry pulp per 100 cubic feet solid ground wood. | Efficiency of conversion. | Screenings per 100 cubic feet solid ground wood. | Average temperature of grinding. | Horsepower divided by pressure \times speed. |
|---------|--------------------------------|---|------------------------------|-------------------------|-------------------------------|---------------------------|-------------------------|-------------------------|-------------|--------------------------------|--------------------------------|----------------------------|---|---------------------------|--------------------------------------|---------------------------|------------------------|--------------|---|---------------------------|--|----------------------------------|--|
| | | Kind of burr. | Surface. | | | | | <i>Lbs. per sq. in.</i> | <i>Lbs.</i> | | | | | | | | <i>Ft. per minute.</i> | <i>Tons.</i> |  |  |  |  |  | Cu. ft. | Lbs. | Inches. | P. ct. | Lbs. |
| 1 | | Diamond point, 6 to inch; spiral, cut 12 to inch. | Same as No. 14 amabilis fir. | 2 | 60 | 24.65 | 225 | 3,049 | 312 | 371 | 2,647 | 117.7 | 252 | 22.30 | 22.30 | 6 $\frac{3}{8}$ | 47.25 | 2,065 | 93.9 | 92.6 | 14.10 | 137 | 0.00624 |
| 2 | | do. | Same surface. | 2 | 60 | 24.65 | 225 | 3,049 | 412 | 469 | 4,430 | 93.0 | 429 | 22.30 | 22.30 | 7 $\frac{1}{8}$ | 47.25 | 2,065 | 92.6 | 92.6 | 14.10 | 137 | .00548 |
| 3 | | do. | do. | 2 | 80 | 32.80 | 225 | 3,049 | 513 | 591 | 6,510 | 78.7 | 627 | 22.30 | 22.30 | 7 $\frac{1}{8}$ | 47.25 | 2,078 | 93.0 | 93.0 | 27.80 | 131 | .00513 |
| 4 | | do. | do. | 2 | 100 | 41.00 | 225 | 3,049 | 611 | 660 | 8,050 | 75.9 | 795 | 22.30 | 22.30 | 7 $\frac{1}{8}$ | 47.25 | 2,022 | 90.7 | 90.7 | 21.80 | 127 | .00490 |
| 5 | | Spiral, cut 12 to inch; straight, cut 3 to inch. | Stone dressed. | 2 | 60 | 24.65 | 100 | 1,355 | 204 | 253 | 2,045 | 99.7 | 207 | 22.30 | 22.30 | 6 $\frac{3}{8}$ | 47.25 | 1,977 | 88.6 | 88.6 | 16.90 | 140 | .00611 |
| 6 | | do. | Same surface. | 2 | 60 | 24.65 | 150 | 2,033 | 320 | 361 | 3,280 | 97.5 | 319 | 22.30 | 22.30 | 6 $\frac{3}{8}$ | 47.25 | 2,056 | 92.1 | 92.1 | 16.10 | 147 | .00638 |
| 7 | | do. | do. | 2 | 60 | 24.65 | 200 | 2,710 | 365 | 420 | 3,940 | 92.6 | 369 | 22.30 | 22.30 | 6 $\frac{3}{8}$ | 47.25 | 2,135 | 95.6 | 95.6 | 14.30 | 139 | .00546 |
| 8 | | do. | do. | 2 | 60 | 24.65 | 250 | 3,388 | 465 | 509 | 5,435 | 85.6 | 533 | 22.30 | 22.30 | 7 | 47.25 | 2,038 | 91.4 | 91.4 | 14.30 | 133 | .00556 |
| 9 | Steamed. | do. | do. | 2 | 40 | 16.40 | 225 | 3,049 | 264 | 317 | 2,125 | 124.0 | 242 | 22.30 | 22.30 | 7 $\frac{1}{8}$ | 47.25 | 1,757 | 78.8 | 78.8 | 34.40 | 134 | .00528 |
| 10 | do. | do. | do. | 2 | 60 | 24.65 | 225 | 3,049 | 357 | 410 | 3,775 | 94.7 | 413 | 22.30 | 22.30 | 7 $\frac{1}{8}$ | 47.25 | 1,830 | 82.1 | 82.1 | 70.50 | 120 | .00475 |
| 11 | do. | do. | do. | 2 | 80 | 32.80 | 225 | 3,049 | 420 | 497 | 5,715 | 88.0 | 526 | 22.30 | 22.30 | 7 | 47.25 | 1,788 | 80.1 | 80.1 | 91.90 | 120 | .00420 |
| 12 | do. | do. | do. | 2 | 100 | 41.00 | 225 | 3,049 | 475 | 537 | 5,375 | 88.4 | 629 | 22.30 | 22.30 | 6 $\frac{3}{8}$ | 47.25 | 1,710 | 76.7 | 76.7 | 101.00 | 117 | .00380 |
| 13 | do. | do. | Stone dressed. | 3 | 50 | 20.50 | 225 | 3,020 | 430 | 579 | 5,110 | 84.0 | 479 | 21.60 | 21.60 | 7 $\frac{1}{8}$ | 43.00 | 2,135 | 98.9 | 98.9 | 16.2 | 136 | .00695 |

¹ For conditions of cooking see Table 32.

TABLE 12.—Grinder runs on *ambilis* fir.¹

| Run No. | Preliminary treatment of wood. | Stone. | | Number of pockets used. | Pressure on 14-inch cylinder. | Pressure per square inch of pocket area. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horse-dry pulp in 24 hours. | Solid ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | | Bone-dry pulp per 100 cubic feet solid ground wood. | Efficiency of conversion. | Screenings per 100 cubic feet solid ground wood. | Average temperature of grinding. | Horsepower divided by pressure X speed. |
|---------|--------------------------------|---|-------------------|-------------------------|-------------------------------|--|-------------------------|-----------------------|--------------------------------|--------------------------------|----------------------------|-----------------------------|---------------------------|--------------------------------------|---------------------------|-------------------|-------|---|---------------------------|--|----------------------------------|---|
| | | Kind of burr. | Surface. | | | | | | | | | | | | | P. ct. | Lbs. | | | | | |
| 1 | ..... | Diamond point, 6 to inch; spiral, cut 12 to inch. | Stone dressed.... | 2 | Lbs. per sq. in. 40 | Lbs. 16.40 | 225 | Ft. per minute. 3,049 | 296 | Tons. 3.200 | 92.5 | Cu. ft. 339 | Lbs. 20.96 | Inches. (2) | 47.56 | 1,888 | 90.1 | 5.60 | 145 | 0.00591 | | |
| 2 | ..... | do. | Same surface.... | 2 | 60 | 24.65 | 225 | 3,049 | 398 | 455 | 4.930 | 80.8 | 518 | 20.96 | (2) | 47.56 | 1,905 | 91.0 | 8.43 | 142 | .00529 | |
| 3 | ..... | do. | do. | 2 | 80 | 32.80 | 225 | 3,049 | 484 | 569 | 6.850 | 70.6 | 735 | 20.96 | (2) | 47.56 | 1,863 | 89.0 | 10.20 | 132 | .00484 | |
| 4 | ..... | do. | do. | 2 | 100 | 41.00 | 225 | 3,049 | 581 | 670 | 8.700 | 66.3 | 975 | 20.96 | (2) | 47.56 | 1,800 | 86.0 | 12.40 | 138 | .00465 | |
| 5 | ..... | do. | do. | 2 | 60 | 24.65 | 160 | 1,355 | 195 | 228 | 2.170 | 90.0 | 233 | 20.96 | (2) | 47.56 | 1,802 | 89.0 | 10.50 | 140 | .00384 | |
| 6 | ..... | do. | do. | 2 | 60 | 24.65 | 150 | 2,033 | 275 | 330 | 2.945 | 93.5 | 332 | 20.96 | (2) | 47.56 | 1,773 | 84.7 | 8.05 | 142 | .00349 | |
| 7 | ..... | do. | do. | 2 | 60 | 24.65 | 200 | 2,710 | 376 | 432 | 4.125 | 91.2 | 461 | 20.96 | (2) | 47.56 | 1,790 | 85.5 | 9.00 | 147 | .00563 | |
| 8 | ..... | do. | do. | 2 | 60 | 24.65 | 250 | 3,388 | 454 | 509 | 5.800 | 78.2 | 596 | 20.96 | (2) | 47.56 | 1,948 | 93.0 | 13.60 | 137 | .00543 | |
| 9 | Steamed. | do. | do. | 2 | 40 | 16.40 | 225 | 3,049 | 223 | 282 | 1.728 | 129.0 | 226 | 20.96 | (2) | 47.56 | 1,530 | 73.0 | 20.60 | 131 | .00445 | |
| 10 | do. | do. | do. | 2 | 60 | 24.65 | 225 | 3,049 | 320 | 381 | 3.225 | 99.2 | 421 | 20.96 | (2) | 47.56 | 1,532 | 73.1 | 34.60 | 124 | .00425 | |
| 11 | do. | do. | do. | 2 | 80 | 32.80 | 225 | 3,049 | 368 | 447 | 3.530 | 104.0 | 468 | 20.96 | (2) | 47.56 | 1,510 | 72.1 | 40.90 | 123 | .00368 | |
| 12 | do. | do. | do. | 2 | 100 | 41.00 | 225 | 3,049 | 434 | 514 | 4.430 | 98.0 | 589 | 20.96 | (2) | 47.56 | 1,505 | 71.9 | 38.20 | 120 | .00347 | |
| 13 | do. | do. | do. | 2 | 60 | 24.65 | 211 | 2,860 | 324 | 394 | 2.920 | 111.0 | 352 | 20.96 | (2) | 47.56 | 1,600 | 79.2 | 18.90 | 138 | .00459 | |
| 14 | do. | do. | do. | 2 | 60 | 24.65 | 181 | 2,455 | 323 | 390 | 3.240 | 99.7 | 355 | 20.96 | (2) | 47.56 | 1,822 | 87.0 | 14.00 | 138 | .00534 | |
| 15 | ..... | Spiral, cut 8 to inch; straight, cut 10 to inch. | Stone dressed.... | 2 | 80 | 32.80 | 225 | 3,029 | 397 | 502 | 4.900 | 81.0 | 485 | 21.10 | (2) | 25.27 | 2,020 | 95.7 | 10.30 | 159 | .00401 | |

: Split wood.

¹ For conditions of cooking see Table 32.

TABLE 13.—Grinder runs on lowland fir (Montana).¹

| Run No. | Preliminary treatment of wood. | Stone. | | Number of pockets used. | Pressure on 14-inch cylinder. | Pressure per square inch. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton bone-dry pulp in 24 hours. | Solid ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | Bone-dry pulp per 100 cubic feet solid ground. | Efficiency of conversion. | Screenings per 100 cubic feet solid ground. | Average temperature of grinding. | Horsepower divided by pressure X speed. |
|---------|--------------------------------|--|--------------------------|-------------------------|-------------------------------|---------------------------|-------------------------|-----------------------|--------------------------------|--------------------------------|----------------------------|---|---------------------------|--------------------------------------|---------------------------|-------------------|--|---------------------------|---|----------------------------------|---|
| | | Kind of burr. | Surface. | | | | | | | | | | | | | | | | | | |
| 1 | Steamed... | Spiral, cut 8 to inch; straight, cut 10 to inch. | Stone dressed... | 2 | Lbs. per sq. in. 40 | Lbs. 16.40 | 175 | Ft. per minute. 2,348 | 157 | 195 | Tons. 1.855 | 84.6 | Cu. ft. 224 | Lbs. 21.40 | Inches. 8 1/8 | P. ct. 48.00 | Lbs. 1,660 | P. ct. 77.5 | Lbs. 21.6 | ° F. 122 | 0.00407 |
| 2 | do. | do. | Same surface | 2 | 60 | 24.65 | 175 | 2,348 | 221 | 273 | 2.765 | 80.0 | 344 | 21.40 | 8 1/8 | 48.00 | 1,610 | 75.2 | 32.9 | 119 | .00382 |
| 3 | do. | do. | do. | 2 | 80 | 32.80 | 175 | 2,348 | 283 | 342 | 3.445 | 82.1 | 409 | 21.40 | 8 | 48.00 | 1,683 | 78.7 | 25.7 | 119 | .00367 |
| 4 | do. | do. | do. | 2 | 40 | 16.40 | 175 | 2,348 | 207 | 260 | 2.980 | 69.5 | 320 | 21.40 | 9 | 48.00 | 1,862 | 87.0 | 7.6 | 136 | .00538 |
| 5 | do. | do. | do. | 2 | 60 | 24.65 | 175 | 2,348 | 280 | 322 | 4.465 | 62.6 | 475 | 21.40 | 8 1/8 | 48.00 | 1,880 | 87.9 | 8.4 | 136 | .00483 |
| 6 | do. | do. | do. | 2 | 80 | 32.80 | 175 | 2,348 | 347 | 387 | 5.650 | 61.4 | 605 | 21.40 | 8 1/8 | 48.00 | 1,870 | 87.4 | 8.7 | 127 | .00450 |
| 7 | do. | do. | do. | 2 | 40 | 16.40 | 100 | 1,342 | 141 | 176 | 1.730 | 81.5 | 192 | 21.40 | 8 1/8 | 48.00 | 1,805 | 84.3 | 5.7 | 139 | .00640 |
| 8 | do. | do. | do. | 2 | 40 | 16.40 | 150 | 2,013 | 185 | 218 | 2.290 | 80.7 | 240 | 21.40 | 8 | 48.00 | 1,910 | 89.2 | 8.2 | 143 | .00561 |
| 9 | do. | do. | do. | 2 | 40 | 16.40 | 200 | 2,684 | 226 | 276 | 2.735 | 82.8 | 290 | 21.40 | 8 1/8 | 48.00 | 1,888 | 88.1 | 5.5 | 139 | .00513 |
| 10 | do. | do. | do. | 2 | 40 | 16.40 | 250 | 3,355 | 255 | 317 | 3.405 | 74.9 | 370 | 21.40 | 8 1/8 | 48.00 | 1,837 | 85.8 | 5.5 | 136 | .00464 |
| 11 | do. | do. | Same as No. 19 | 2 | 40 | 16.40 | 175 | 2,348 | 213 | 258 | 2.345 | 90.3 | 234 | 21.65 | 6 1/8 | 46.40 | 2,000 | 92.4 | 4.9 | 142 | .00553 |
| 12 | do. | do. | Engelmann spruce(Mont.). | 2 | 60 | 24.65 | 175 | 2,348 | 294 | 339 | 3.750 | 78.4 | 366 | 21.65 | 6 1/8 | 46.40 | 2,045 | 94.5 | 6.3 | 138 | .00507 |
| 13 | do. | do. | Same surface | 2 | 80 | 32.80 | 175 | 2,348 | 358 | 413 | 5.100 | 70.3 | 488 | 21.65 | 7 | 46.40 | 2,090 | 96.5 | 6.9 | 139 | .00465 |
| 14 | do. | do. | do. | 2 | 60 | 24.65 | 100 | 1,342 | 192 | 226 | 2.315 | 83.0 | 224 | 21.65 | 6 1/8 | 46.40 | 2,060 | 95.1 | 4.8 | 132 | .00580 |
| 15 | do. | do. | do. | 2 | 60 | 24.65 | 150 | 2,013 | 273 | 311 | 3.245 | 84.2 | 329 | 21.65 | 7 1/8 | 46.40 | 2,170 | 91.0 | 4.8 | 140 | .00551 |
| 16 | do. | do. | do. | 2 | 60 | 24.65 | 200 | 2,684 | 353 | 403 | 4.265 | 82.6 | 409 | 21.65 | 6 1/8 | 46.40 | 2,090 | 96.5 | 5.2 | 138 | .00533 |
| 17 | do. | do. | do. | 2 | 60 | 24.65 | 250 | 3,355 | 384 | 436 | 4.790 | 80.3 | 492 | 21.65 | 6 1/8 | 46.40 | 1,941 | 89.7 | 4.4 | 142 | .00465 |

¹ For conditions of cooking see Table 32.

GROUND-WOOD PULP.

TABLE 14.—Grinder runs on noble fir.¹

| Run No. | Preliminary treatment of wood. | Stone. | | Number of pockets used. | Pressure on 14-inch cylinder. | Pressure per square inch of pocket area. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton bone-dry pulp in 24 hours. | Solid ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | | Bone-dry pulp per 100 cubic feet solid ground wood. | Efficiency of conversion. | Screens per 100 cubic feet solid ground wood bone-dry. | Average temperature of grinding. | Horsepower divided by pressure \times speed. |
|---------|--|--|-------------------------|-------------------------|-------------------------------|--|-------------------------|-----------------------|--------------------------------|--------------------------------|----------------------------|---|---------------------------|--------------------------------------|---------------------------|-------------------|------------|---|---------------------------|--|----------------------------------|--|
| | | Kind of burr. | Surface. | | | | | | | | | | | | | P. ct. | Lbs. | | | | | |
| 1 | | Spiral, cut 8 to inch; straight, cut 10 to inch. | Stone dressed.... | 2 | Lbs. per sq. in. 40 | Lbs. 16.40 | 225 | Ft. per minute. 3,020 | 222 | Tons. 307 | 1,980 | 112.0 | Cu. ft. 216 | Lbs. 21.05 | Inches. | P. ct. 34.80 | Lbs. 1,835 | P. ct. 87.1 | Lbs. 17.4 | ° F. 143 | 0.00449 | |
| 2 | | do. | Same surface. | 2 | 60 | 24.65 | 225 | 3,020 | 290 | 413 | 3.410 | 85.0 | 345 | 21.05 | ..... | 34.80 | 1,980 | 94.0 | 20.1 | 131 | .00389 | |
| 3 | | do. | do. | 2 | 80 | 32.80 | 225 | 3,020 | 406 | 487 | 5.100 | 79.6 | 487 | 21.05 | ..... | 34.80 | 2,000 | 99.2 | 18.9 | 131 | .00410 | |
| 4 | | do. | do. | 2 | 100 | 41.00 | 225 | 3,020 | 470 | 581 | 6.750 | 69.5 | 695 | 21.05 | ..... | 34.80 | 1,950 | 92.6 | 22.6 | 118 | .00380 | |
| 5 | | do. | do. | 2 | 60 | 24.65 | 100 | 1,342 | 190 | 218 | 2.275 | 83.5 | 252 | 21.05 | ..... | 34.80 | 1,805 | 85.7 | 22.0 | 125 | .00574 | |
| 6 | | do. | do. | 2 | 60 | 24.65 | 150 | 2,013 | 233 | 284 | 2.920 | 79.8 | 311 | 21.05 | ..... | 34.80 | 1,875 | 89.0 | 16.5 | 123 | .00470 | |
| 7 | | do. | do. | 2 | 60 | 24.65 | 200 | 2,684 | 290 | 370 | 3.340 | 86.8 | 336 | 21.05 | ..... | 34.80 | 1,990 | 94.5 | 15.7 | 132 | .00437 | |
| 8 | Steamed. | do. | do. | 2 | 60 | 24.65 | 250 | 3,355 | 336 | 392 | 3.990 | 84.2 | 386 | 21.05 | ..... | 34.80 | 2,060 | 97.9 | 11.2 | 128 | .00406 | |
| 9 | do. | do. | do. | 2 | 40 | 16.40 | 225 | 3,020 | 189 | 256 | 1.990 | 95.5 | 272 | 21.05 | ..... | 34.80 | 1,465 | 69.6 | 33.6 | 121 | .00382 | |
| 10 | do. | do. | do. | 2 | 60 | 24.65 | 225 | 3,020 | 271 | 326 | 2.965 | 91.3 | 441 | 21.05 | ..... | 34.80 | 1,342 | 63.8 | 82.1 | 116 | .00364 | |
| 11 | do. | do. | do. | 2 | 80 | 32.80 | 225 | 3,020 | 314 | 407 | 3.290 | 95.5 | 437 | 21.05 | ..... | 34.80 | 1,502 | 71.4 | 89.5 | 112 | .00317 | |
| 12 | do. | do. | do. | 2 | 60 | 24.65 | 225 | 3,020 | 296 | 382 | 2.930 | 101.0 | 437 | 21.05 | ..... | 34.80 | 1,860 | 88.4 | 44.4 | 123 | .00398 | |
| 13 | do. | do. | do. | 2 | 80 | 32.80 | 225 | 3,020 | 313 | 356 | 4.070 | 76.9 | 414 | 21.05 | ..... | 34.80 | 1,969 | 93.5 | 16.4 | 123 | .00421 | |
| 14 | do. | do. | Same as No. 256 spruce. | 2 | 80 | 32.80 | 225 | 3,020 | 438 | 492 | 5.390 | 81.4 | 564 | 20.96 | ..... | 36.60 | 1,916 | 91.5 | 21.0 | 130 | .00443 | |
| 15 | do. | do. | Same surface. | 2 | 80 | 32.80 | 225 | 3,020 | 415 | 462 | 4.450 | 93.2 | 456 | 21.20 | ..... | 33.25 | 1,950 | 92.0 | 21.2 | 132 | .00419 | |
| 16 | do. | do. | Stone dressed. | 3 | 50 | 20.50 | 225 | 3,020 | 393 | 504 | 4.275 | 92.0 | 442 | 21.05 | ..... | 34.80 | 1,933 | 91.9 | 14.8 | 151 | .00636 | |
| 17 | Straight, cut 3 to inch; spiral, cut 12 to inch. | do. | Same as No. 275 spruce. | 2 | 40 | 16.40 | 200 | 2,774 | 277 | 319 | 4.560 | 60.7 | 571 | 21.05 | ..... | 34.80 | 1,595 | 75.7 | 332.0 | 117 | .00609 | |
| 18 | do. | do. | Same as No. 17. | 2 | 20 | 8.20 | 200 | 2,774 | 155 | 195 | 2.150 | 72.0 | 220 | 21.05 | ..... | 34.80 | 1,950 | 92.6 | 35.9 | 130 | .00682 | |

¹ For conditions of cooking see Table 34.

Nos. 17 and 18 were run on a coarse-grit stone.

TABLE 16.—Grinder runs on western hemlock.¹

| Run No. | Preliminary treatment of wood. | Stone. | | Number of pockets used. | Pressure on 14-inch cylinder. | Pressure per square inch. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Tons. | Horsepower per ton bone-dry pulp in 24 hours. | Solid rossi ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | Bone-dry pulp per 100 cubic feet solid rossi wood. | Efficiency of conversion. | Screenings per 100 cubic feet solid rossi wood bone-dry. | Average temperature of grinding. | Horsepower divided by pressure \times speed. |
|---------|--------------------------------|--------------------------------|---------------------------------|-------------------------|-------------------------------|---------------------------|-------------------------|-------------------|--------------------------------|--------------------------------|----------------------------|-------|---|---------------------------------|--------------------------------------|---------------------------|-------------------|--|---------------------------|--|----------------------------------|--|
| | | Kind of burr. | Surface. | | Lbs. per sq. in. | Lbs. | | | | | | | | | | | | | | | | |
| 1 | | Straight, cut 3 to 12 to inch. | Same as for Sitka spruce No. 1. | 3 | 30 | 12.30 | 225 | 3,085 | 305 | 354 | 2,270 | 134.5 | 218.0 | 24.40 | 24.40 | (2) | 27.73 | 2,080 | 85.2 | 10.91 | 178.9 | 0.00803 |
| 2 | | do. | Same as for Sitka spruce No. 4. | 3 | 20 | 8.20 | 250 | 3,427 | 218 | 258 | 1,715 | 127.0 | 144.0 | 28.35 | 28.35 | (2) | 24.15 | 2,380 | 84.0 | 8.85 | 161.1 | .00775 |
| 3 | | do. | Same surface. | 3 | 40 | 16.40 | 250 | 3,427 | 376 | 391 | 3,480 | 93.7 | 288.0 | 28.35 | 28.35 | (2) | 24.15 | 2,420 | 85.4 | 13.50 | 154.3 | .00580 |
| 4 | | do. | do. | 3 | 60 | 24.65 | 250 | 3,427 | 552 | 625 | 5,850 | 94.4 | 524.0 | 28.35 | 28.35 | (2) | 24.15 | 2,235 | 78.8 | 13.46 | 150.3 | .00654 |
| 5 | | do. | do. | 3 | 60 | 24.65 | 100 | 1,366 | 232 | 309 | 1,935 | 130.0 | 189.0 | 23.42 | 23.42 | (2) | 25.20 | 2,042 | 87.2 | 14.10 | 149.9 | .00749 |
| 6 | | do. | Sitka spruce. | 3 | 60 | 24.65 | 150 | 2,049 | 339 | 388 | 2,390 | 142.0 | 241.5 | 23.42 | 23.42 | (2) | 25.20 | 1,980 | 84.5 | 12.92 | 157.3 | .00670 |
| 7 | | do. | do. | 3 | 60 | 24.65 | 200 | 2,732 | 447 | 512 | 2,715 | 165.0 | 258.0 | 23.42 | 23.42 | (2) | 25.20 | 2,106 | 89.9 | 11.90 | 164.8 | .00664 |
| 8 | | do. | do. | 3 | 60 | 24.65 | 250 | 3,415 | 539 | 617 | 2,830 | 192.2 | 270.0 | 23.42 | 23.42 | (2) | 25.20 | 2,072 | 88.4 | 12.60 | 168.4 | .00640 |
| 9 | Steamed. | do. | Same as No. 6. | 3 | 60 | 24.65 | 200 | 2,732 | 348 | 406 | 1,892 | 183.7 | 237.0 | 23.58 | 23.58 | (2) | 26.62 | 1,595 | 67.6 | 14.63 | 124.8 | .00516 |
| 10 | | do. | Same surface. | 3 | 60 | 24.65 | 172 | 2,350 | 340 | 415 | 1,291 | 263.0 | 151.0 | 23.58 | 23.58 | (2) | 26.62 | 1,715 | 72.8 | 7.78 | 164.9 | .00586 |
| 11 | | do. | Same as No. 49. | 2 | 40 | 16.40 | 225 | 3,073 | 267 | 314 | 3,130 | 85.3 | 277.0 | 24.77 | 24.77 | (2) | 24.20 | 2,260 | 91.3 | 8.56 | 116.0 | .00530 |
| 12 | | do. | tamarack. | 2 | 60 | 24.65 | 225 | 3,073 | 336 | 389 | 4,550 | 73.9 | 403.0 | 24.77 | 24.77 | (2) | 24.20 | 2,260 | 91.3 | 17.80 | 103.6 | .00444 |
| 13 | | do. | do. | 2 | 80 | 32.80 | 225 | 3,073 | 430 | 490 | 6,130 | 70.2 | 571.0 | 24.77 | 24.77 | (2) | 24.20 | 2,145 | 86.6 | 16.30 | 117.5 | .00426 |
| 14 | | do. | do. | 2 | 100 | 41.00 | 225 | 3,073 | 480 | 549 | 7,690 | 62.5 | 675.0 | 24.77 | 24.77 | (2) | 24.20 | 2,278 | 92.0 | 19.96 | 110.7 | .00381 |
| 15 | | do. | do. | 2 | 100 | 41.00 | 225 | 3,073 | 480 | 549 | 7,690 | 62.5 | 675.0 | 24.77 | 24.77 | (2) | 24.20 | 2,278 | 92.0 | 19.96 | 110.7 | .00381 |
| 16 | | do. | do. | 2 | 100 | 41.00 | 225 | 3,073 | 480 | 549 | 7,690 | 62.5 | 675.0 | 24.77 | 24.77 | (2) | 24.20 | 2,278 | 92.0 | 19.96 | 110.7 | .00381 |
| 17 | | do. | do. | 2 | 100 | 41.00 | 225 | 3,073 | 480 | 549 | 7,690 | 62.5 | 675.0 | 24.77 | 24.77 | (2) | 24.20 | 2,278 | 92.0 | 19.96 | 110.7 | .00381 |
| 18 | | Straight, cut 3 to 12 to inch. | Stone dressed. | 3 | 50 | 20.50 | 225 | 3,069 | 479 | 555 | 3,800 | 126.0 | 338.0 | 24.77 | 24.77 | (2) | 24.20 | 2,250 | 91.0 | 10.80 | 169.0 | .00760 |

¹ For conditions of cooking see Table 32.² Split wood.³ For runs 15 to 17, inclusive, see runs on "Mixtures of woods."

TABLE 17.—Grinder runs on tamarack.¹

| Run No. | Preliminary treatment of wood. | Stone. | | Number of pockets used. | Pressure on 14-inch cylinder. | Pressure per square inch of pocket area. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton bone-dry pulp in 24 hours. | Solid ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | Bone-dry pulp per 100 cubic feet solid ground wood. | Efficiency of conversion. | Screenings per 100 cubic feet solid ground wood bone-dry. | Average temperature of grinding. | Horsepower divided by pressure × speed. | | |
|---------|--------------------------------|--|----------|-------------------------|-------------------------------|--|-------------------------|-------------------|--------------------------------|--------------------------------|----------------------------|---|---------------------------|--------------------------------------|---------------------------|-------------------|---|---------------------------|---|----------------------------------|---|--------|--------|
| | | Kind of burr. | Surface. | | | | | | | | | | | | | | | | | | | | |
| 21 | | { Straight, cut 3 to 12 to inch; spiral, cut 12 to inch. | } | 3 | { 40 16.4 50 20.5 } | Lbs. | 175 | 2,445 | 368 | 470 | 4,380 | 96.8 | Tons. | Cu.ft. | Lbs. | Inches. | P.ct. | Lbs. | P.ct. | Lbs. | ° F. | . | |
| 21 | | | | | | | | | | | | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | | | | | | | | | | | | |
| 21 | | { Straight, cut 3 to 12 to inch; spiral, cut 12 to inch. | } | 3 | { 40 16.4 50 20.5 } | Lbs. | 175 | 2,445 | 400 | 451 | 4,332 | 92.3 | . | . | . | . | . | . | . | . | . | . | |
| 21 | | | | | | | | | | | | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | | | | | | | | | | | | |
| 21 | | { Straight, cut 3 to 12 to inch; spiral, cut 12 to inch. | } | 3 | { 40 16.4 50 20.5 } | Lbs. | 175 | 2,445 | 406 | 442 | 4,445 | 91.4 | . | . | . | . | . | . | . | . | . | . | |
| 21 | | | | | | | | | | | | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | { Straight, cut 3 to 12 to inch; spiral, cut 12 to inch. | } | 3 | { 40 16.4 50 20.5 } | Lbs. | 175 | 2,445 | 400 | . | 4,500 | 90.0 | . | 32.38 | . | 24.41 | 2,648 | 81.9 | . | . | 174.6 | . | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | { Straight, cut 3 to 12 to inch; spiral, cut 12 to inch. | } | 3 | { 40 16.4 60 24.65 } | Lbs. | 175 | 2,428 | 332 | 377 | 3,725 | 89.1 | 286.0 | 32.22 | 54 | 26.22 | 2,606 | 80.9 | 11.09 | 161.2 | . | .00834 | |
| 3 | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | { Straight, cut 3 to 12 to inch; spiral, cut 12 to inch. | } | 3 | { 20 8.2 40 16.4 60 24.65 } | Lbs. | 225 | 3,122 | 229 | 261 | 1,660 | 138.0 | 125.9 | 33.52 | 54 | 29.18 | 2,640 | 78.8 | 10.94 | 171.0 | . | .00761 | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | { Diamond point, 6 to inch. | } | 3 | { 60 24.65 80 32.0 } | Lbs. | 225 | 3,122 | 580 | 656 | 8,265 | 70.1 | 608.0 | 33.52 | 54 | 29.18 | 2,780 | 82.9 | 10.77 | 151.7 | . | .00800 | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | { Straight, cut 3 to 12 to inch; spiral, cut 12 to inch. | } | 3 | { 60 24.65 80 32.0 } | Lbs. | 175 | 2,428 | 445 | 171 | . | . | . | 32.25 | 54 | 27.20 | . | 2,720 | 81.1 | 12.47 | 147.6 | . | .00753 |
| 9 | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | { Straight, cut 3 to 12 to inch; spiral, cut 12 to inch. | } | 3 | { 60 24.65 80 32.0 } | Lbs. | 175 | 2,428 | 422 | 485 | 1,542 | 273.0 | . | 32.25 | 54 | 27.20 | . | 2,490 | 77.1 | 11.8 | 133.4 | . | .00705 |
| 10 | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | | { Straight, cut 3 to 12 to inch; spiral, cut 12 to inch. | } | 3 | { 40 16.4 60 24.65 } | Lbs. | 200 | 2,762 | 334 | 384 | 6,215 | 53.7 | 505.0 | 32.25 | 6 | 27.20 | 2,460 | 76.2 | 12.5 | 123.4 | . | .00736 | |
| 11 | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | Steamed. | { Straight, cut 3 to 12 to inch; spiral, cut 12 to inch. | } | 3 | { 40 16.4 60 24.65 } | Lbs. | 200 | 2,762 | 306 | 356 | 4,470 | 68.5 | 359.0 | 32.25 | 54 | 27.20 | 2,490 | 77.1 | 11.8 | 133.4 | . | .00675 | |
| 12 | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | do. | | | | | | | | | | | | | | | | | | | | | | |
| 13 | do. | | | | | | | | | | | | | | | | | | | | | | |
| 14 | do. | { Straight, cut 3 to 12 to inch; spiral, cut 12 to inch. | } | 3 | { 40 16.4 60 24.65 } | Lbs. | 200 | 2,762 | 347 | 387 | 5,510 | 63.0 | 404.0 | 32.78 | 61 | 28.88 | 2,730 | 83.4 | 9.51 | 136.1 | . | .00750 | |
| 14 | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | do. | | | | | | | | | | | | | | | | | | | | | | |
| 14 | do. | | | | | | | | | | | | | | | | | | | | | | |
| 15 | do. | { Straight, cut 3 to 12 to inch; spiral, cut 12 to inch. | } | 3 | { 40 16.4 60 24.65 } | Lbs. | 200 | 2,762 | 330 | 393 | 4,455 | 71.0 | 340.0 | 32.78 | 61 | 28.88 | 2,620 | 80.0 | 14.46 | 149.8 | . | .00727 | |
| 15 | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | do. | | | | | | | | | | | | | | | | | | | | | | |
| 15 | do. | | | | | | | | | | | | | | | | | | | | | | |

¹ For conditions of cooking see Table 32.² Commercial.

TABLE 17.—Grinder run on tamarack—Continued.

| Run No. | Preliminary treatment of wood. | Stone. | | Number of pockets used. | Pressure on 14-inch cylinder. | Pressure per square inch. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton bone-dry pulp in 24 hours. | Solid ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | Bone-dry pulp per 100 cubic feet solid wood. | Efficiency of conversion. | Screenings per 100 cubic feet solid wood bone-dry. | Average temperature of grinding. | Horsepower divided by pressure \times speed. |
|---------|--------------------------------|---|---|-------------------------|-------------------------------|---------------------------|-------------------------|-------------------|--------------------------------|--------------------------------|----------------------------|---|---------------------------|--------------------------------------|---------------------------|-------------------|--|---------------------------|--|----------------------------------|--|
| | | Kind of burr. | Surface. | | Lbs. per sq. in. | Lbs. | | Ft per minute. | | | Tons. | | Cu. ft. | | Inches. | P. ct. | Lbs. | P. ct. | Lbs. | ° F. | |
| 16 | Steamed.. | Straight, cut 3 to inch; spiral, cut 12 to inch. | Same surface.... | 3 | 40 | 16.4 | 200 | 2,762 | 314 | 332 | 3,510 | 89.5 | 266.0 | 32.78 | 5½ | 28.88 | 2,638 | 80.5 | 16.70 | 150.2 | 0.00692 |
| 17 | do. | do. | do. | 3 | 40 | 16.4 | 200 | 2,762 | 330 | 397 | 3,475 | 95.0 | 277.0 | 29.70 | 5½ | 33.01 | 2,515 | 84.6 | 11.88 | 163.0 | .00728 |
| 18 | do. | do. | do. | 3 | 40 | 16.4 | 200 | 2,762 | 338 | 389 | 3,240 | 104.3 | 261.0 | 29.70 | 5½ | 33.01 | 2,482 | 83.6 | 10.99 | 156.3 | .00745 |
| 19 | do. | do. | do. | 3 | 40 | 16.4 | 200 | 2,762 | 338 | 356 | 2,950 | 97.6 | 233.5 | 33.70 | 5½ | 27.93 | 2,524 | 74.9 | 16.90 | 143.4 | .00635 |
| 20 | do. | do. | do. | 3 | 40 | 16.4 | 200 | 2,762 | 326 | 378 | 5,195 | 62.8 | 380.0 | 33.70 | 5½ | 27.93 | 2,730 | 81.0 | 12.86 | 125.4 | .00719 |
| 21 | do. | do. | do. | 3 | 40 | 16.4 | 200 | 2,762 | 314 | 370 | 3,550 | 81.5 | 308.0 | 32.36 | 6½ | 28.04 | 2,500 | 77.3 | 16.40 | 141.8 | .00692 |
| 22 | do. | do. | do. | 3 | 40 | 16.4 | 200 | 2,762 | 295 | 349 | 3,035 | 97.2 | 274.0 | 32.36 | 6½ | 28.04 | 2,218 | 68.5 | 11.60 | 143.6 | .00650 |
| 23 | do. | do. | do. | 3 | 40 | 16.4 | 200 | 2,762 | 291 | 361 | 3,480 | 83.7 | 309.0 | 32.36 | 5½ | 28.04 | 2,250 | 69.5 | 16.90 | 132.0 | .00647 |
| 24 | do. | do. | do. | 3 | 40 | 16.4 | 200 | 2,762 | 318 | 435 | 5,050 | 68.9 | 378.0 | 32.36 | 5½ | 28.04 | 2,670 | 82.5 | 8.35 | 139.1 | .00766 |
| 25 | do. | do. | do. | 3 | 40 | 16.4 | 200 | 2,762 | 302 | 354 | 3,000 | 100.6 | 250.0 | 34.25 | 5½ | 25.32 | 2,398 | 70.0 | 16.88 | 141.5 | .00661 |
| 26 | do. | do. | do. | 3 | 30 | 12.3 | 225 | 3,085 | 302 | 343 | 1,898 | 159.2 | 144.8 | 33.29 | 5½ | 22.51 | 2,620 | 78.7 | 8.14 | 187.2 | .00795 |
| 27 | Steamed.. | Spiral, cut 6 to inch. | Same as No. 56 hemlock. | 2 | 40 | 16.4 | 250 | 3,427 | 288 | 326 | 4,780 | 60.3 | 384.0 | 31.47 | 5½ | 25.58 | 2,490 | 79.0 | 16.10 | 103.6 | .00512 |
| 28 | do. | do. | do. | 2 | 55 | 22.55 | 201 | 2,760 | 283 | 311 | 4,420 | 64.0 | 366.0 | 31.47 | 5½ | 25.58 | 2,412 | 76.5 | 18.42 | 113.0 | .00455 |
| 29 | do. | do. | do. | 2 | 70 | 28.7 | 179 | 2,458 | 280 | 310 | 4,350 | 64.4 | 368.0 | 31.47 | 5½ | 25.58 | 2,360 | 75.0 | 22.30 | 117.8 | .00397 |
| 30 | do. | do. | do. | 2 | 85 | 34.8 | 158 | 2,165 | 289 | 322 | 3,912 | 73.9 | 330.0 | 31.47 | 5½ | 25.58 | 2,365 | 75.1 | 28.65 | 108.3 | .00383 |
| 31 | do. | do. | do. | 2 | 100 | 41.0 | 136 | 1,868 | 278 | 311 | 3,840 | 72.4 | 314.0 | 31.47 | 6 | 25.58 | 2,442 | 77.6 | 30.35 | 113.0 | .00364 |
| 32 | do. | Straight, cut 3 to inch; diamond point, 10 to inch. | Same as for No. 9 California lodgepole. | 2 | 40 | 16.4 | 225 | 3,081 | 258 | 288 | 2,865 | 90.0 | 252 | 31.68 | 5½ | 24.54 | 2,275 | 71.7 | 9.70 | 127.1 | .00510 |
| 33 | do. | do. | do. | 2 | 60 | 24.65 | 225 | 3,081 | 360 | 408 | 4,270 | 84.3 | 363.0 | 31.68 | 5½ | 24.54 | 2,350 | 74.1 | 22.20 | 136.5 | .00473 |
| 34 | do. | do. | do. | 2 | 80 | 32.8 | 225 | 3,081 | 421 | 482 | 4,790 | 88.0 | 410.0 | 31.68 | 5½ | 24.54 | 2,338 | 73.6 | 36.70 | 128.5 | .00417 |
| 35 | Bolled.. | do. | do. | 2 | 40 | 16.4 | 225 | 3,081 | 272 | 300 | 2,630 | 107.6 | 206.5 | 31.68 | 6 | 24.54 | 2,450 | 77.3 | 15.47 | 134.7 | .00538 |
| 36 | do. | do. | do. | 2 | 60 | 24.65 | 225 | 3,081 | 382 | 420 | 4,670 | 81.9 | 381.0 | 31.68 | 6 | 24.54 | 2,450 | 77.3 | 18.30 | 142.5 | .00502 |
| 37 | do. | do. | do. | 2 | 80 | 32.8 | 225 | 3,081 | 438 | 499 | 4,565 | 95.8 | 385.0 | 31.47 | 6½ | 25.58 | 2,370 | 75.3 | 28.70 | 130.6 | .00433 |

| | | | | | | | | | | | | | | | | | | | | |
|----|--|--|---|----|-------|-----|-------|-----|-----|-------|-------|-------|-------|-----------------|-------|-------|------|-------|-------|--------|
| 38 | Steamed... | do. | 3 | 40 | 16.4 | 200 | 2,740 | 360 | 390 | 2,950 | 122.0 | 222.0 | 31.68 | 6 $\frac{1}{2}$ | 24.54 | 2,660 | 83.9 | 9.66 | 141.2 | .00801 |
| 39 | do. | do. | 3 | 40 | 16.4 | 225 | 3,031 | 262 | 281 | 2,050 | 127.9 | 185.8 | 31.68 | 4 | 24.54 | 2,208 | 69.6 | 17.60 | 142.3 | .00518 |
| 40 | do. | do. | 3 | 40 | 24.65 | 225 | 3,081 | 351 | 305 | 2,705 | 92.5 | 330.0 | 31.68 | 4 | 24.54 | 2,300 | 72.5 | 15.50 | 135.7 | .00461 |
| 41 | do. | do. | 3 | 80 | 22.8 | 225 | 3,081 | 429 | 465 | 4,455 | 96.1 | 390.0 | 31.68 | 5 | 24.54 | 2,290 | 72.3 | 18.50 | 129.8 | .00424 |
| 42 | Boiled | Straight, cut 8 to inch. | 3 | 40 | 16.4 | 225 | 3,080 | 224 | 260 | 1,675 | 133.8 | 164.0 | 30.72 | 5 | 24.47 | 2,042 | 66.6 | 13.28 | 148.3 | .00444 |
| 43 | do. | do. | 3 | 40 | 24.65 | 225 | 3,080 | 299 | 336 | 2,745 | 109.0 | 240.0 | 30.72 | 5 | 24.47 | 2,285 | 74.5 | 15.07 | 133.4 | .00394 |
| 44 | do. | do. | 3 | 80 | 32.8 | 225 | 3,080 | 360 | 410 | 3,495 | 103.0 | 316.0 | 30.72 | 5 | 24.47 | 2,210 | 72.0 | 21.00 | 127.6 | .00356 |
| 45 | do. | do. | 3 | 60 | 24.65 | 225 | 3,080 | 308 | 346 | 2,975 | 103.7 | 274.0 | 30.40 | 5 | 25.75 | 2,168 | 71.4 | 20.27 | 125.9 | .00405 |
| 46 | Boiled in s a l t brine. | do. | 3 | 60 | 24.65 | 225 | 3,080 | 312 | 337 | 3,265 | 95.5 | 264.5 | 33.14 | 5 | 24.34 | 2,465 | 74.5 | 14.36 | 136.9 | .00410 |
| 47 | Steamed... | Straight, cut 3 to inch; spiral, cut 12 to inch. | 3 | 60 | 24.65 | 200 | 2,732 | 422 | 471 | 1,459 | 290.0 | 138.0 | 32.75 | 6 | 23.62 | 2,280 | 69.6 | 10.79 | 177.3 | .00626 |
| 48 | do. | do. | 3 | 60 | 24.65 | 200 | 2,732 | 366 | 440 | 4,610 | 79.4 | 394.0 | 32.75 | 5 | 23.62 | 2,338 | 71.4 | 24.9 | 108.3 | .00543 |
| 49 | do. | do. | 3 | 60 | 24.65 | 150 | 2,049 | 352 | 406 | 5,400 | 65.2 | 426.0 | 32.75 | 5 | 23.62 | 2,535 | 77.4 | 11.09 | 109.0 | .00696 |
| 50 | do. | do. | 3 | 60 | 24.65 | 150 | 2,049 | 352 | 406 | 5,400 | 65.2 | 426.0 | 32.75 | 5 | 23.62 | 2,535 | 77.4 | 11.09 | 109.0 | .00696 |
| 51 | do. | do. | 3 | 60 | 24.65 | 150 | 2,049 | 352 | 406 | 5,400 | 65.2 | 426.0 | 32.75 | 5 | 23.62 | 2,535 | 77.4 | 11.09 | 109.0 | .00696 |
| 52 | do. | do. | 3 | 60 | 24.65 | 150 | 2,049 | 352 | 406 | 5,400 | 65.2 | 426.0 | 32.75 | 5 | 23.62 | 2,535 | 77.4 | 11.09 | 109.0 | .00696 |
| 53 | Spiral, cut 8 to inch; straight, cut 10 to inch. | do. | 3 | 4 | 16.4 | 225 | 3,069 | 430 | 505 | 4,510 | 95.4 | 324.0 | 32.44 | 5 | 25.25 | 2,780 | 85.6 | 10.10 | 170.0 | .00854 |
| 54 | do. | do. | 3 | 30 | 12.3 | 250 | 3,387 | 286 | 325 | 2,615 | 109.5 | 233.0 | 31.21 | 5 | 25.20 | 2,245 | 72.0 | 13.50 | 144.0 | .00686 |
| 55 | Steamed... | Spiral, cut 8 to inch; straight, cut 10 to inch. | 3 | 35 | 14.3 | 221 | 2,990 | 288 | 352 | 2,755 | 104.5 | 234.0 | 31.21 | 5 | 25.20 | 2,350 | 75.2 | 13.65 | 134.0 | .00674 |
| 56 | do. | do. | 3 | 40 | 16.4 | 196 | 2,658 | 290 | 348 | 2,725 | 106.3 | 240.0 | 31.21 | 5 | 25.20 | 2,275 | 72.8 | 14.00 | 150.0 | .00665 |
| 57 | do. | do. | 3 | 45 | 18.4 | 187 | 2,262 | 285 | 339 | 2,533 | 112.5 | 220.0 | 31.21 | 5 | 25.20 | 2,305 | 73.9 | 12.60 | 145.0 | .00684 |
| 58 | do. | do. | 3 | 50 | 20.5 | 154 | 2,086 | 290 | 329 | 2,420 | 120.0 | 210.0 | 31.21 | 5 | 25.20 | 2,300 | 73.6 | 9.50 | 155.0 | .00677 |
| 59 | do. | do. | 3 | 55 | 22.5 | 153 | 2,076 | 286 | 323 | 2,500 | 114.3 | 220.0 | 31.21 | 5 | 25.20 | 2,270 | 72.7 | 16.20 | 146.0 | .00612 |
| 60 | do. | do. | 3 | 60 | 24.65 | 140 | 1,898 | 286 | 323 | 2,165 | 132.0 | 198.0 | 31.21 | 5 | 25.20 | 2,186 | 70.1 | 11.50 | 156.0 | .00611 |
| 61 | do. | do. | 3 | 40 | 16.4 | 230 | 3,387 | 269 | 312 | 3,615 | 81.2 | 285.0 | 31.21 | 5 | 25.20 | 2,222 | 71.2 | 12.95 | 139.0 | .00484 |
| 62 | do. | do. | 3 | 45 | 18.4 | 232 | 3,143 | 267 | 316 | 3,390 | 78.8 | 294.0 | 31.21 | 5 | 25.20 | 2,305 | 73.9 | 9.65 | 145.0 | .00461 |
| 63 | do. | do. | 2 | 50 | 20.5 | 225 | 3,049 | 273 | 324 | 3,385 | 80.6 | 288.0 | 31.21 | 5 | 25.20 | 2,340 | 75.0 | 11.25 | 139.0 | .00436 |
| 64 | do. | do. | 2 | 55 | 22.5 | 220 | 2,980 | 272 | 330 | 3,080 | 88.3 | 266.0 | 31.21 | 5 | 25.20 | 2,320 | 74.3 | 10.50 | 146.0 | .00405 |
| 65 | do. | do. | 2 | 60 | 24.65 | 201 | 2,722 | 272 | 335 | 2,880 | 94.5 | 247.0 | 31.21 | 5 | 25.20 | 2,330 | 74.6 | 14.15 | 142.0 | .00405 |
| 66 | do. | do. | 2 | 65 | 26.6 | 213 | 2,852 | 274 | 342 | 2,670 | 102.8 | 232.0 | 31.21 | 5 | 25.20 | 2,302 | 73.8 | 12.80 | 141.0 | .00357 |
| 67 | do. | do. | 2 | 70 | 28.7 | 190 | 2,575 | 272 | 351 | 2,745 | 99.1 | 233.0 | 31.21 | 5 | 25.20 | 2,350 | 75.3 | 11.95 | 147.0 | .00368 |
| 68 | do. | do. | 2 | 75 | 30.7 | 170 | 2,287 | 272 | 351 | 2,745 | 99.1 | 233.0 | 31.21 | 5 | 25.20 | 2,350 | 75.3 | 11.95 | 147.0 | .00368 |
| 69 | do. | do. | 2 | 80 | 32.8 | 150 | 2,049 | 352 | 406 | 5,400 | 65.2 | 426.0 | 32.46 | 5 | 28.64 | 2,190 | 67.5 | 19.70 | 136.0 | .00444 |
| 70 | do. | Diamond point, 6 to inch. | 2 | 60 | 24.65 | 222 | 3,008 | 333 | 382 | 4,710 | 70.7 | 434.0 | 32.46 | 5 | 28.64 | 2,175 | 67.0 | 21.90 | 135.0 | .00448 |
| 71 | do. | do. | 2 | 60 | 24.65 | 218 | 2,938 | 335 | 384 | 4,605 | 72.7 | 460.0 | 32.46 | 5 | 28.64 | 2,000 | 61.6 | 19.40 | 137.0 | .00460 |

1 See runs on mixed woods.

TABLE 17.—Grinder runs on tamarack—Continued.

| Run No. | Preliminary treatment of wood. | Stone. | | Number of pockets used. | Pressure on 14-inch cylinder. | Pressure per square inch of pocket area. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton bone-dry pulp in 24 hours. | Solid tressed wood ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | Bone-dry pulp per 100 cubic feet solid tressed wood. | Efficiency of conversion. | Screenings per 100 cubic feet solid tressed wood bone-dry. | Average temperature of grinding. | Horsepower divided by pressure \times speed. |
|---------|--------------------------------|--|---------------------------|-------------------------|-------------------------------|--|-------------------------|-------------------|--------------------------------|--------------------------------|----------------------------|---|--|--------------------------------------|---------------------------|-------------------|--|---------------------------|--|----------------------------------|--|
| | | Kind of burr. | Surface. | | Lbs. per sq. in. | Lbs. | Feet per minute. | | | | Tons. | | | | Inches. | | | | | | |
| 72 | Steamed.. | Diamond point, 6 to inch. | Same surface.... | 2 | 60 | 24.65 | 220 | 2,981 | 335 | 399 | 4.370 | 76.7 | 386.0 | 32.46 | 31 | 28.64 | 2,260 | 69.6 | 27.20 | 133.0 | 0.00456 |
| 73 | do..... | do..... | do..... | 2 | 60 | 24.65 | 217 | 2,941 | 336 | 398 | 4.050 | 73.9 | 374.0 | 32.46 | 58 | 28.64 | 2,435 | 75.0 | 27.30 | 137.0 | .00463 |
| 74 | do..... | do..... | do..... | 2 | 60 | 24.65 | 205 | 2,780 | 333 | 391 | 4.490 | 74.2 | 360.0 | 32.46 | 54 | 28.64 | 2,490 | 76.7 | 23.30 | 137.0 | .00486 |
| 75 | do..... | do..... | do..... | 2 | 60 | 24.65 | 197 | 2,673 | 335 | 388 | 4.775 | 70.1 | 372.0 | 32.46 | 48 | 28.64 | 2,560 | 78.9 | 18.30 | 131.0 | .00508 |
| 76 | do..... | do..... | do..... | 2 | 60 | 24.65 | 185 | 2,505 | 335 | 394 | 5.075 | 66.0 | 378.0 | 32.46 | 5 | 28.64 | 2,680 | 82.5 | 19.30 | 140.0 | .00511 |
| 77 | do..... | do..... | do..... | 2 | 60 | 24.65 | 170 | 2,302 | 334 | 404 | 5.780 | 57.9 | 380.0 | 32.46 | 54 | 28.64 | 3,040 | 93.6 | 11.10 | 138.0 | .00587 |
| 78 | do..... | Spiral, cut 8 to inch; straight, cut 10 to inch. | Same as No. 12 black gum. | 2 | 40 | 16.40 | 175 | 2,348 | 216 | 276 | 1.320 | 163.6 | 119.0 | 30.88 | 6 | 33.60 | 2,215 | 71.7 | 11.4 | 164.0 | .00561 |
| 179 | do..... | do..... | Same surface.... | 2 | 40 | 16.40 | 175 | 2,348 | 195 | 258 | 1.020 | 191.0 | 102.0 | 29.37 | 10 | 32.80 | 2,000 | 68.1 | 12.7 | 170.0 | .00506 |
| 80 | do..... | do..... | Stone dressed.... | 2 | 40 | 16.40 | 175 | 2,348 | 207 | 251 | .560 | 370.0 | 63.0 | 30.88 | 7 | 33.60 | 1,770 | 57.4 | 8.8 | 174.0 | .00538 |
| 181 | do..... | do..... | Same surface.... | 2 | 40 | 16.40 | 175 | 2,348 | 202 | 245 | .541 | 373.0 | 65.0 | 29.37 | 8 | 32.80 | 1,672 | 57.0 | 15.9 | 175.0 | .00524 |

1 Wood for these runs partially decayed.

TABLE 18.—Grinder runs on western larch.

| Run No. | Stone. | | Number of pockets used. | Pressure on 14-inch cylinder. | Pressure per square inch of pocket area. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton bone-dry pulp in 24 hours. | Solid tossed wood ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | Bone-dry pulp per 100 cubic feet solid tossed wood. | Efficiency of conversion. | Screenings per 100 cubic feet solid tossed wood. | Average temperature of grinding. | Horsepower divided by pressure \times speed. |
|---------|---------------|--|-------------------------|-------------------------------|--|-------------------------|-------------------|--------------------------------|--------------------------------|----------------------------|---|---------------------------------------|--------------------------------------|---------------------------|-------------------|---|---------------------------|--|----------------------------------|--|
| | Kind of burr. | Surface. | | Lbs. per sq. in. | Lbs. | | Ft. per minute. | | | | | | | | | | | | | |
| 1 | Steamed... | Straight, cut 3 to 12 to inch; spiral, cut 12 to inch. | 3 | 40 | 16.4 | 200 | 2,762 | 321 | 374 | 2,730 | 117.6 | 282.0 | 30.12 | 7 | 37.64 | 1,937 | 64.3 | 14.40 | 157.7 | 0.00709 |
| 2 | | do..... | 3 | 30 | 12.3 | 225 | 3,085 | 334 | 378 | 3,220 | 103.6 | 338.0 | 27.94 | 7½ | 34.87 | 1,902 | 68.1 | 6.70 | 168.7 | .00380 |
| 3 | | do..... | 3 | 60 | 24.65 | 100 | 1,366 | 267 | 298 | 1,830 | 146.0 | 212.0 | 26.55 | 7 | 36.38 | 1,728 | 65.1 | 6.20 | 138.2 | .00793 |
| 4 | | do..... | 3 | 30 | 12.3 | 225 | 3,073 | 304 | 323 | 1,340 | 227.0 | 150.8 | 26.55 | 7 | 36.38 | 1,778 | 67.0 | 6.54 | 154.3 | .00805 |
| 5 | | do..... | 3 | 60 | 24.65 | 225 | 3,073 | 508 | 595 | 2,725 | 186.3 | 323.0 | 26.55 | 7 | 36.38 | 1,657 | 62.4 | 7.27 | 166.5 | .00670 |
| 6 | | do..... | 3 | 40 | 16.4 | 175 | 2,390 | 303 | 344 | 1,086 | 279.0 | 115.0 | 26.55 | 7 | 36.38 | 1,887 | 71.1 | 5.80 | 177.9 | .00772 |
| 7 | | Spiral, cut 8 to 10 to inch; straight, cut 10 to inch. | 2 | 60 | 24.65 | 175 | 2,387 | 309 | 357 | 3,570 | 86.5 | 314.0 | 27.62 | 9½ | 40.28 | 2,270 | 82.1 | 12.85 | 149.0 | .00525 |
| 8 | | do..... | 2 | 40 | 16.4 | 225 | 3,069 | 304 | 342 | 2,525 | 120.1 | 227.0 | 27.62 | 8½ | 40.28 | 2,223 | 80.5 | 10.40 | 157.0 | .00605 |
| 9 | | do..... | 2 | 60 | 24.65 | 225 | 3,069 | 401 | 442 | 4,155 | 96.6 | 376.0 | 27.62 | 9½ | 40.28 | 2,213 | 80.0 | 4.70 | 155.0 | .00530 |
| 10 | | do..... | 2 | 80 | 32.8 | 225 | 3,069 | 473 | 567 | 5,490 | 86.3 | 515.0 | 27.62 | 9½ | 40.28 | 2,125 | 77.0 | 12.35 | 142.0 | .00470 |
| 11 | | do..... | 2 | 80 | 32.8 | 175 | 2,387 | 307 | 348 | 456 | 4,355 | 87.6 | 27.62 | 7½ | 40.28 | 2,142 | 77.5 | 9.90 | 146.0 | .00487 |
| 12 | | do..... | 2 | 80 | 32.8 | 125 | 1,705 | 307 | 348 | 3,445 | 89.1 | 312.0 | 27.62 | 7½ | 40.28 | 2,206 | 79.9 | 10.90 | 154.0 | .00549 |

1 For conditions of cooking see Table 32.

TABLE 19.—Grinder runs on *Montana lodgepole pine*.¹

| Run No. | Preliminary treatment of wood. | Stone. | | Number of pockets used. | Pressure on 14-inch cyl-inder. | Pressure per square inch of pocket area. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton bone-dry pulp in 24 hours. | Solid ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | | Bone-dry pulp per 100 cubic feet solid ground wood. | Efficiency of conversion. | Screenings per 100 cubic feet solid ground wood. | Average temperature of grinding. | Horsepower divided by pressure \times speed. |
|---------|--------------------------------|--|--|-------------------------|--------------------------------|--|-------------------------|-------------------|--------------------------------|--------------------------------|----------------------------|---|---------------------------|--------------------------------------|---------------------------|-------------------|-------|---|---------------------------|--|----------------------------------|--|
| | | Kind of burr. | Surface. | | | | | | | | | | | | | P. ct. | Lbs. | | | | | |
| 1 | | Straight, cut 3 to inch; spiral, cut 12 to inch. | Same as for run No. 23 spruce. | 3 | 40 | 16.4 | 172 | 2,442 | 337.0 | 383 | 2.710 | 124.3 | 247.8 | 27.20 | 6 $\frac{1}{2}$ | 16.90 | 2,190 | 80.5 | 8.68 | 170.8 | 0.00840 | |
| 2 | | do. | Stone dressed. | 3 | 20 | 8.2 | 225 | 3,122 | 233.0 | 263 | 2.210 | 105.3 | 216.0 | 25.00 | 7 | 32.60 | 2,040 | 81.6 | 13.70 | 137.4 | .00910 | |
| 3 | | do. | Same surface. | 3 | 40 | 16.4 | 225 | 3,122 | 412.0 | 453 | 5.940 | 69.4 | 553.0 | 25.00 | 6 $\frac{1}{2}$ | 32.60 | 2,145 | 85.9 | 17.76 | 137.9 | .00804 | |
| 4 | | do. | do. | 3 | 60 | 24.65 | 225 | 3,122 | 574.0 | 660 | 8.905 | 64.0 | 930.0 | 25.00 | 7 $\frac{1}{2}$ | 32.60 | 1,970 | 77.1 | 25.80 | 148.0 | .00745 | |
| 5 | | do. | do. | 3 | 20 | 8.2 | 175 | 2,428 | 183.6 | 208 | 1.700 | 108.0 | 159.6 | 26.10 | 6 $\frac{1}{2}$ | 18.80 | 2,130 | 81.6 | 8.96 | 86.0 | .00921 | |
| 6 | | do. | do. | 3 | 40 | 16.4 | 175 | 2,428 | 341.5 | 382 | 3.530 | 96.7 | 343.0 | 26.10 | 6 $\frac{1}{2}$ | 18.80 | 2,060 | 78.9 | 7.69 | 89.6 | .00856 | |
| 7 | | do. | do. | 3 | 60 | 24.65 | 175 | 2,428 | 482.5 | 545 | 5.405 | 88.2 | 511.0 | 26.10 | 6 $\frac{1}{2}$ | 18.80 | 2,140 | 82.0 | 17.75 | 87.8 | .00805 | |
| 8 | Steamed | do. | Same as yellow pine No. 3. | 3 | 40 | 16.4 | 200 | 2,762 | 289.0 | 339 | 2.795 | 103.3 | 288.0 | 26.48 | 6 $\frac{1}{2}$ | 19.52 | 1,942 | 73.4 | 22.73 | 148.3 | .00638 | |
| 9 | | do. | Same as for western yellow pine No. 4. | 3 | 30 | 12.3 | 225 | 3,085 | 318.0 | 356 | 2.795 | 113.7 | 223.0 | 26.57 | 6 $\frac{1}{2}$ | 13.67 | 2,500 | 94.2 | 13.40 | 171.0 | .00837 | |
| 10 | | Straight, cut 3 to inch; spiral, cut 10 to inch. | Same as for western yellow pine run No. 7. | 3 | 60 | 24.65 | 250 | 3,435 | 588.0 | 650 | 6.285 | 93.6 | 588.0 | 26.55 | 6 $\frac{1}{2}$ | 15.22 | 2,135 | 80.4 | 11.66 | 150.9 | .00695 | |
| 11 | | do. | Same surface. | 3 | 40 | 16.4 | 250 | 3,435 | 424.0 | 477 | 3.375 | 125.7 | 303.0 | 26.55 | 6 $\frac{1}{2}$ | 15.22 | 2,223 | 83.9 | 10.12 | 165.3 | .00752 | |
| 12 | | do. | do. | 3 | 20 | 8.2 | 250 | 3,435 | 228.0 | 269 | 964 | 237.0 | 92.0 | 26.55 | 6 $\frac{1}{2}$ | 15.22 | 2,093 | 78.8 | 6.84 | 176.8 | .00810 | |
| 13 | Boiled | Straight, cut 8 to inch. | Same as No. 46 tamarack. | 2 | 40 | 16.4 | 225 | 3,080 | 271.0 | 269 | 1.635 | 141.1 | 187.8 | 23.95 | 6 $\frac{1}{2}$ | 24.90 | 1,741 | 72.8 | 17.06 | 140.7 | .00457 | |
| 14 | do. | do. | Same surface. | 2 | 60 | 24.65 | 225 | 3,080 | 320.0 | 356 | 2.500 | 128.0 | 270.0 | 23.95 | 6 $\frac{1}{2}$ | 24.90 | 1,850 | 77.3 | 24.15 | 136.0 | .00421 | |
| 15 | do. | do. | do. | 2 | 80 | 32.8 | 225 | 3,080 | 374.0 | 419 | 2.820 | 132.7 | 304.0 | 23.95 | 6 $\frac{1}{2}$ | 24.90 | 1,850 | 77.3 | 20.50 | 129.9 | .00770 | |
| 16 | | Straight, cut 3 to inch; spiral, cut 12 to inch. | Same as No. 209 spruce. | 3 | 60 | 24.65 | 100 | 1,367 | 251.0 | 295 | 2.612 | 96.1 | 241.0 | 24.70 | 7 | 24.80 | 2,170 | 87.9 | 16.59 | 127.1 | .00745 | |
| 17 | | do. | Same surface. | 3 | 60 | 24.65 | 150 | 2,046 | 375.0 | 428 | 3.670 | 102.2 | 334.0 | 24.70 | 7 | 24.80 | 2,195 | 88.9 | 13.59 | 124.4 | .00741 | |
| 18 | | do. | do. | 3 | 60 | 24.65 | 200 | 2,732 | 486.0 | 536 | 4.395 | 110.7 | 406.0 | 24.70 | 7 | 24.80 | 2,160 | 87.5 | 16.62 | 135.0 | .00722 | |
| 19 | | do. | do. | 3 | 60 | 24.65 | 250 | 3,415 | 599.0 | 676 | 5.650 | 106.0 | 530.0 | 24.70 | 6 $\frac{1}{2}$ | 24.80 | 2,130 | 86.3 | 16.50 | 136.3 | .00711 | |
| 20 | | Spiral, cut 8 to inch; straight, cut 10 to inch. | Same as No. 18 red fir. | 2 | 40 | 16.4 | 225 | 3,063 | 263.0 | 308 | 2.040 | 129.0 | 195.0 | 23.40 | 6 $\frac{1}{2}$ | 24.80 | 2,085 | 89.1 | 7.69 | 133.0 | .00322 | |

| | | | | | | | | | | | | | | | | | | | | |
|----|--|--------------|---|-----|-------|-----|-------|-------|-----|-------|-------|-------|-------|----|-------|-------|------|-------|-------|--------|
| 21 | do. | Same surface | 2 | 60 | 24.65 | 225 | 3,069 | 360.0 | 409 | 2,655 | 135.7 | 256.0 | 23.40 | 67 | 24.80 | 2,073 | 88.5 | 8.61 | 160.8 | .00475 |
| 22 | do. | do. | 2 | 80 | 32.8 | 225 | 3,069 | 441.0 | 513 | 4,340 | 101.8 | 423.0 | 23.40 | 67 | 24.80 | 2,050 | 87.6 | 8.01 | 144.4 | .00439 |
| 23 | do. | do. | 2 | 100 | 41.0 | 225 | 3,069 | 510.0 | 596 | 5,390 | 94.9 | 515.0 | 23.40 | 67 | 24.80 | 2,090 | 89.4 | 10.91 | 150.0 | .00405 |
| 24 | do. | do. | | | | | | | | | | | | | | | | | | |
| 25 | do. | do. | | | | | | | | | | | | | | | | | | |
| 26 | Straight, cut 3 to inch; spiral, cut 12 to inch. | do. | 3 | 55 | 22.55 | 225 | 3,069 | 500.0 | 581 | 3,630 | 137.8 | 334.0 | 24.61 | 63 | 25.00 | 2,175 | 88.3 | 12.20 | 173.0 | .00723 |

¹ For conditions of cooking see Table 32.

² See runs on mixtures of woods.

TABLE 20.—Grinder runs on *California lodgepole pine*.¹

| Run No. | Preliminary treatment of wood. | Stone. | | Number of pockets used. | Pressure on 14-inch cylinder. | Pressure per square inch of pocket area. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton of bone-dry pulp in 24 hours. | Solid ground in 24 hours. | Weight per cubic foot of bone-dry wood. | Average diameter of wood. | Moisture in wood. | | Bone-dry pulp per 100 cubic feet solid tressed wood. | Efficiency of conversion. | Screens per 100 cubic bone-dry. | Average temperature of grinding. | Horsepower divided by pressure×speed. |
|---------|--------------------------------|---|--------------------------------|-------------------------|-------------------------------|--|-------------------------|-------------------|--------------------------------|--------------------------------|----------------------------|--|---------------------------|---|---------------------------|-------------------|-------|--|---------------------------|---------------------------------|----------------------------------|---------------------------------------|
| | | Kind of burr. | Surface. | | Lbs. per sq. in. | Lbs. | | | | | Tons. | | | | Inches. | P. ct. | Lbs. | P. ct. | | | | ° F. |
| 1 | Steamed... | Straight, cut 3 to 12 to inch. | Same as larch No. 1. | 3 | 40 | 16.4 | 200 | 2,762 | 312 | 358 | 2,515 | 124.2 | 329.5 | 24.74 | 6 1/2 | 22.78 | 1,526 | 61.7 | 16.86 | 155.3 | | 0.00689 |
| 2 | | do..... | Same as western hemlock No. 1. | 3 | 30 | 12.3 | 225 | 3,085 | 326 | 364 | 2,370 | 137.6 | 227 | 25.38 | (2) | 11.00 | 2,082 | 82.2 | 11.30 | 172.1 | | .00859 |
| 3 | | do..... | Same as spruce No. 154. | 2 | 80 | 32.8 | 225 | 3,085 | 513 | 555 | 4,930 | 104.0 | 524 | 23.58 | (2) | 28.04 | 1,882 | 79.9 | 23.44 | 157.7 | | .00506 |
| 4 | | Spiral, cut 6 to inch | Same as spruce No. 191. | 3 | 20 | 8.2 | 175 | 2,400 | 193 | 222 | 1,661 | 116.2 | 161 | 25.35 | (2) | 10.93 | 2,062 | 81.5 | 11.57 | 142.1 | | .00980 |
| 5 | | do..... | Same surface..... | 3 | 40 | 16.4 | 175 | 2,400 | 357 | 391 | 2,230 | 84.4 | 432 | 25.35 | (2) | 10.93 | 1,960 | 77.4 | 15.90 | 121.6 | | .00907 |
| 6 | | do..... | do..... | 3 | 60 | 24.65 | 175 | 2,400 | 474 | 505 | 7,150 | 66.2 | 761 | 25.35 | (2) | 10.93 | 1,880 | 74.2 | 17.67 | 108.1 | | .00800 |
| 7 | | Straight, cut 3 to inch; diamond point, 10 to inch. | Stone dressed..... | 3 | 20 | 8.2 | 225 | 3,081 | 228 | 264 | 1,475 | 154.6 | 164 | 25.35 | (2) | 10.93 | 1,800 | 71.0 | 7.99 | 144.5 | | .00902 |
| 8 | | do..... | Same surface..... | 3 | 40 | 16.4 | 225 | 3,081 | 392 | 444 | 3,245 | 121.0 | 344 | 25.35 | (2) | 10.93 | 1,886 | 74.4 | 7.95 | 149.2 | | .00775 |
| 9 | | do..... | do..... | 3 | 60 | 24.65 | 225 | 3,081 | 579 | 651 | 6,400 | 90.5 | 695 | 25.35 | (2) | 10.93 | 1,842 | 72.7 | 21.00 | 114.4 | | .00760 |
| 10 | | Straight, cut 3 to inch; spiral, cut 12 to inch. | Stone dressed..... | 3 | 60 | 24.65 | 100 | 1,366 | 264 | 323 | 1,140 | 232.0 | 124.4 | 22.29 | (2) | 22.33 | 1,832 | 82.2 | 12.49 | 152.7 | | .00784 |
| 11 | | do..... | Same surface..... | 3 | 60 | 24.65 | 150 | 2,049 | 374 | 430 | 1,745 | 214.0 | 193 | 22.29 | (2) | 22.33 | 1,776 | 79.5 | 12.22 | 161.1 | | .00740 |
| 12 | | do..... | do..... | 3 | 60 | 24.65 | 200 | 2,732 | 512 | 594 | 2,055 | 249.0 | 226 | 22.29 | (2) | 22.33 | 1,623 | 72.9 | 13.17 | 168.8 | | .00760 |
| 13 | | do..... | do..... | 3 | 60 | 24.65 | 250 | 3,415 | 540 | 630 | 2,595 | 208.0 | 204 | 22.29 | (2) | 22.33 | 1,763 | 79.1 | 13.40 | 164.8 | | .00641 |
| 14 | | do..... | Stone dressed..... | 2 | 20 | 8.2 | 225 | 3,073 | 126 | 157 | 504 | 250.0 | 69 | 22.67 | (2) | 24.67 | 1,707 | 75.1 | 5.88 | 139.9 | | .00500 |
| 15 | | do..... | Same surface..... | 2 | 40 | 16.4 | 225 | 3,073 | 270 | 301 | 1,675 | 161.2 | 178 | 22.67 | (2) | 24.67 | 1,878 | 82.7 | 7.30 | 164.0 | | .00585 |
| 16 | | do..... | do..... | 2 | 60 | 24.65 | 225 | 3,073 | 358 | 402 | 2,675 | 134.0 | 286 | 22.67 | (2) | 24.67 | 1,810 | 79.8 | 6.97 | 149.7 | | .00475 |
| 17 | | do..... | do..... | 2 | 80 | 32.8 | 225 | 3,073 | 439 | 508 | 3,725 | 117.4 | 386 | 22.67 | (2) | 24.67 | 1,930 | 85.0 | 10.60 | 139.6 | | .00455 |
| 18 | | do..... | do..... | 2 | 100 | 41.0 | 225 | 3,073 | 577 | 655 | 4,975 | 116.0 | 531 | 22.67 | (2) | 24.67 | 1,872 | 82.5 | 6.73 | 151.5 | | .00458 |
| 19 | | Spiral, cut 8 to inch; straight, cut 10 to inch. | Same as No. 23. Lodgepole. | 2 | 40 | 16.4 | 225 | 3,069 | 259 | 307 | 1,081 | 239.5 | 111 | 23.05 | (2) | 26.05 | 1,952 | 84.6 | 7.05 | 175.6 | | .00514 |
| 20 | | do..... | do..... | 2 | 60 | 24.65 | 225 | 3,069 | 347 | 410 | 1,763 | 196.7 | 184 | 23.05 | (2) | 26.05 | 1,921 | 83.4 | 9.65 | 168.0 | | .00459 |
| 21 | | do..... | Same surface..... | 2 | 80 | 32.8 | 225 | 3,069 | 409 | 465 | 2,925 | 139.6 | 303 | 23.05 | (2) | 26.05 | 1,932 | 83.8 | 10.15 | 165.1 | | .00405 |

TABLE 21.—Grinder runs on western yellow pine.¹

| Run No. | Preliminary treatment of wood. | Stone. | | Number of pockets used. | Pressure on 14-inch cyl-inder. | Pressure per square inch of pocket area. | Revolutions per minute. | Peripheral speed. | | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per 100 bone-dry pulp in 24 hours. | Solid ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | | Bone-dry pulp per 100 cubic feet solid tressed wood. | Efficiency of conversion. | Screenings per 100 cubic feet solid tressed wood bone-dry. | Average temperature of grinding. | Horsepower divided by pressure X speed. |
|---------|--------------------------------|--|-------------------------|-------------------------|--------------------------------|--|-------------------------|-------------------------|-------------|--------------------------------|--------------------------------|----------------------------|---|---------------------------|--------------------------------------|---------------------------|------------------------|--------------|--|---------------------------|--|----------------------------------|---|
| | | Kind of burr. | Surface. | | | | | <i>Lbs. per sq. in.</i> | <i>Lbs.</i> | | | | | | | | <i>Ft. per minute.</i> | <i>Tons.</i> |  |  |  |  |  | Cu. ft. | Lbs. | Inches. | P. ct. | Lbs. |
| 1 | Steamed. | Straight, cut 3 to inch; spiral, cut 12 to inch. | Same as hemlock No. 53. | 3 | 40 | 16.4 | 200 | 2,768 | 376 | 422 | 4,100 | 76.4 | 91.7 | 486.0 | 23.50 | 2 7 | 54.54 | 2,182 | 1,688 | 71.8 | 26.05 | 121.1 | 0.00828 |
| 2 | Boiled. | do. | Same as hemlock No. 51. | 3 | 40 | 16.4 | 200 | 2,762 | 307 | 356 | 4,020 | 76.4 | 76.4 | 368.0 | 23.65 | 2 8 | 54.54 | 2,182 | 1,688 | 92.3 | 26.05 | 124.7 | 0.00677 |
| 3 | Steamed. | do. | Stone dressed. | 3 | 40 | 16.4 | 200 | 2,762 | 326 | 394 | 4,400 | 74.1 | 74.1 | 392.0 | 28.24 | 10 | 43.83 | 2,243 | 1,688 | 79.2 | 34.10 | 129.2 | 0.00719 |
| 4 | do. | do. | Same as spruce No. 151. | 3 | 30 | 12.3 | 225 | 3,085 | 337 | 386 | 3,255 | 103.7 | 103.7 | 313.0 | 25.11 | 9 1 | 16.53 | 2,080 | 1,688 | 82.9 | 10.78 | 166.0 | 0.00888 |
| 5 | do. | do. | Stone dressed. | 3 | 60 | 24.65 | 250 | 3,435 | 580 | 661 | 6,620 | 87.6 | 87.6 | 610.0 | 26.55 | 9 1 | 24.15 | 2,170 | 1,688 | 81.8 | 15.42 | 157.5 | 0.00855 |
| 6 | do. | do. | Same surface. | 3 | 40 | 16.4 | 250 | 3,435 | 466 | 511 | 4,850 | 96.0 | 96.0 | 436.0 | 26.55 | 10 | 24.15 | 2,222 | 1,688 | 83.8 | 8.54 | 156.9 | 0.00829 |
| 7 | do. | do. | do. | 2 | 80 | 32.8 | 150 | 2,056 | 356 | 393 | 3,100 | 69.8 | 69.8 | 489.0 | 26.55 | 9 1 | 24.15 | 2,085 | 1,688 | 78.5 | 27.60 | 134.1 | 0.00328 |
| 8 | Boiled. | Straight, cut 8 to inch. | Same as No. 7. | 2 | 40 | 16.4 | 225 | 3,080 | 244 | 259 | 1,620 | 150.7 | 150.7 | 219.0 | 22.50 | 9 1 | 23.40 | 1,480 | 1,688 | 65.8 | 14.92 | 129.6 | 0.0483 |
| 9 | do. | do. | Same surface. | 2 | 60 | 24.65 | 225 | 3,080 | 317 | 341 | 2,865 | 110.7 | 110.7 | 326.0 | 22.50 | 9 1 | 23.40 | 1,757 | 1,688 | 78.0 | 20.20 | 109.4 | 0.0417 |
| 10 | do. | do. | do. | 2 | 80 | 32.8 | 225 | 3,080 | 370 | 401 | 3,075 | 120.2 | 120.2 | 384.0 | 22.50 | 8 1 | 23.40 | 1,603 | 1,688 | 71.4 | 39.60 | 116.5 | 0.0366 |
| 11 | Steamed. | Straight, cut 3 to inch; spiral, cut 12 to inch. | Same as No. 10. | 3 | 40 | 16.4 | 200 | 2,732 | 320 | 397 | 1,011 | 316.0 | 316.0 | 114.3 | 24.25 | 8 1 | 23.09 | 1,770 | 1,688 | 73.0 | 21.20 | 165.3 | 0.0715 |
| 12 | do. | do. | Same as No. 19. | 3 | 60 | 24.65 | 100 | 1,366 | 269 | 300 | 2,630 | 102.3 | 102.3 | 275.0 | 23.97 | 10 1 | 22.31 | 1,912 | 1,688 | 79.9 | 26.64 | 105.0 | 0.0799 |
| 13 | do. | do. | Same as No. 19. | 3 | 60 | 24.65 | 150 | 2,049 | 403 | 437 | 2,912 | 138.2 | 138.2 | 301.0 | 23.97 | 8 1 | 22.31 | 1,936 | 1,688 | 80.9 | 27.65 | 122.4 | 0.0796 |
| 14 | do. | do. | Same surface. | 3 | 60 | 24.65 | 200 | 2,732 | 529 | 580 | 3,777 | 140.0 | 140.0 | 392.0 | 23.97 | 9 1 | 22.31 | 1,930 | 1,688 | 80.6 | 24.07 | 123.9 | 0.0784 |
| 15 | do. | do. | do. | 3 | 60 | 24.65 | 250 | 3,415 | 654 | 736 | 4,800 | 134.6 | 134.6 | 501.0 | 23.97 | 8 1 | 22.31 | 1,940 | 1,688 | 81.0 | 17.60 | 117.1 | 0.0776 |
| 16 | do. | do. | do. | 2 | 40 | 16.4 | 225 | 3,069 | 290 | 338 | 2,533 | 114.3 | 114.3 | 255.0 | 22.90 | 9 1 | 28.65 | 1,900 | 1,688 | 86.9 | 8.37 | 150.8 | 0.0576 |
| 17 | do. | do. | Stone dressed. | 2 | 60 | 24.65 | 225 | 3,069 | 410 | 470 | 3,593 | 81.2 | 81.2 | 473.0 | 22.90 | 9 1 | 28.65 | 2,105 | 1,688 | 92.0 | 12.68 | 113.9 | 0.0541 |
| 18 | do. | do. | Same surface. | 2 | 80 | 32.8 | 225 | 3,069 | 434 | 496 | 6,595 | 65.9 | 65.9 | 616.0 | 22.90 | 9 1 | 28.65 | 2,140 | 1,688 | 93.4 | 12.69 | 113.8 | 0.0431 |
| 19 | do. | do. | do. | 2 | 100 | 41.0 | 225 | 3,069 | 513 | 577 | 8,150 | 62.9 | 62.9 | 736.0 | 22.90 | 9 1 | 28.65 | 2,065 | 1,688 | 90.2 | 22.30 | 125.6 | 0.0407 |
| 20 | do. | do. | do. | 2 | 100 | 41.0 | 225 | 3,069 | 513 | 577 | 8,150 | 62.9 | 62.9 | 736.0 | 22.90 | 9 1 | 28.65 | 2,065 | 1,688 | 90.2 | 22.30 | 125.6 | 0.0407 |
| 21 | do. | do. | do. | 2 | 100 | 41.0 | 225 | 3,069 | 513 | 577 | 8,150 | 62.9 | 62.9 | 736.0 | 22.90 | 9 1 | 28.65 | 2,065 | 1,688 | 90.2 | 22.30 | 125.6 | 0.0407 |
| 22 | do. | do. | do. | 2 | 100 | 41.0 | 225 | 3,069 | 513 | 577 | 8,150 | 62.9 | 62.9 | 736.0 | 22.90 | 9 1 | 28.65 | 2,065 | 1,688 | 90.2 | 22.30 | 125.6 | 0.0407 |
| 23 | do. | do. | do. | 2 | 100 | 41.0 | 225 | 3,069 | 513 | 577 | 8,150 | 62.9 | 62.9 | 736.0 | 22.90 | 9 1 | 28.65 | 2,065 | 1,688 | 90.2 | 22.30 | 125.6 | 0.0407 |
| 24 | do. | do. | do. | 2 | 100 | 41.0 | 225 | 3,069 | 513 | 577 | 8,150 | 62.9 | 62.9 | 736.0 | 22.90 | 9 1 | 28.65 | 2,065 | 1,688 | 90.2 | 22.30 | 125.6 | 0.0407 |

TABLE 23.—Grinder runs on *loblolly pine*.¹

| Run No. | Preliminary treatment of wood. | Stone. | | Number of pockets used. | Pressure on 14-inch cyl-inder. | Pressure per square inch of pocket area. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton, bone-dry pulp in 24 hours. | Solid ground in 24 hours. | Weight per cubic foot, bone-dry wood. | Average diameter of wood. | Moisture in wood. | Bone-dry pulp per 100 cubic feet, solid ground wood. | Efficiency of conversion. | Screenings per 100 cubic feet, solid ground wood. | Average temperature of grinding. | Horsepower divided by pressure X speed. |
|---------|--------------------------------|------------------|-------------------------|-------------------------|--------------------------------|--|-------------------------|-------------------|--------------------------------|--------------------------------|----------------------------|--|---------------------------|---------------------------------------|---------------------------|-------------------|--|---------------------------|---|----------------------------------|---|
| | | Kind of burr. | Surface. | | | | | | | | | | | | | | | | | | |
| 1 | | Full-cut wood. | Stone dressed | 2 | 40 | 16.40 | 175 | 2,348 | 225 | 248 | 2,430 | 92.5 | 204 | 28.56 | ..... | 20.20 | 2,380 | 83.4 | 15.3 | 150 | 0.00584 |
| 2 | | do. | Same surface. | 2 | 60 | 24.65 | 175 | 2,348 | 314 | 367 | 3,830 | 81.7 | 337 | 28.56 | ..... | 20.20 | 2,280 | 79.9 | 12.5 | 136 | .00541 |
| 3 | | do. | Same as No. 5. | 2 | 80 | 32.80 | 175 | 2,348 | 368 | 419 | 3,195 | 115.0 | 260 | 28.56 | ..... | 20.20 | 2,400 | 86.2 | 14.1 | 156 | .00478 |
| 4 | | do. | Same surface. | 2 | 60 | 21.65 | 175 | 2,348 | 318 | 350 | 2,455 | 120.5 | 196 | 28.56 | ..... | 20.20 | 2,500 | 87.6 | 15.5 | 156 | .00549 |
| 5 | | do. | do. | 2 | 40 | 16.40 | 175 | 2,348 | 226 | 264 | 1,165 | 194.0 | 199 | 28.56 | ..... | 20.20 | 2,350 | 82.4 | 8.7 | 169 | .00587 |
| 6 | | do. | Stone dressed. | 2 | 60 | 24.65 | 100 | 1,342 | 209 | 230 | 2,225 | 93.8 | 179 | 28.56 | ..... | 20.20 | 2,490 | 87.3 | 12.4 | 150 | .00631 |
| 7 | | do. | Same surface. | 2 | 60 | 24.65 | 150 | 2,013 | 296 | 332 | 3,140 | 94.2 | 247 | 28.56 | ..... | 20.20 | 2,540 | 89.0 | 13.2 | 147 | .00597 |
| 8 | | do. | do. | 2 | 60 | 24.65 | 250 | 3,355 | 430 | 489 | 4,865 | 88.3 | 404 | 28.56 | ..... | 20.20 | 2,410 | 84.5 | 12.0 | 146 | .00520 |
| 9 | | do. | Same as No. 18. | 2 | 80 | 32.80 | 225 | 3,020 | 397 | 465 | 3,400 | 116.9 | 313 | 28.56 | ..... | 20.20 | 1,900 | 69.8 | 19.4 | 145 | .00401 |
| 10 | | do. | Same as No. 15. | 2 | 40 | 16.40 | 175 | 2,348 | 198 | 251 | 1,772 | 111.0 | 145 | 28.52 | ..... | 16.80 | 2,445 | 82.9 | 22.8 | 149 | .00513 |
| 11 | | do. | Same as No. 23. | 2 | 60 | 24.65 | 175 | 2,348 | 302 | 362 | 3,305 | 91.3 | 262 | 28.52 | ..... | 16.80 | 2,520 | 85.4 | 22.7 | 149 | .00521 |
| 12 | | do. | Same as No. 24. | 2 | 80 | 32.80 | 175 | 2,348 | 371 | 413 | 4,350 | 85.2 | 347 | 28.52 | ..... | 16.80 | 2,510 | 85.0 | 17.4 | 143 | .00481 |
| 13 | | do. | Same as No. 27, spruce. | 2 | 20 | 8.20 | 200 | 2,774 | 129 | 150 | 1,800 | 71.6 | 123 | 28.52 | ..... | 16.80 | 2,930 | ..... | 17.7 | 129 | .00568 |
| 14 | | Spring-cut wood. | Stone dressed. | 2 | 40 | 16.40 | 175 | 2,348 | 220 | 278 | 1,585 | 138.5 | 143 | 27.56 | ..... | 23.62 | 2,220 | 80.6 | 8.8 | 158 | .00571 |
| 15 | | do. | Same as No. 3. | 2 | 60 | 24.65 | 175 | 2,348 | 307 | 367 | 2,490 | 123.3 | 214 | 27.56 | ..... | 23.62 | 2,320 | 84.2 | 14.9 | 157 | .00530 |
| 16 | | do. | Same surface. | 2 | 80 | 32.80 | 175 | 2,348 | 366 | 437 | 3,375 | 108.5 | 280 | 27.56 | ..... | 23.62 | 2,415 | 87.6 | 14.4 | 146 | .00475 |
| 17 | | do. | Same as No. 8. | 2 | 60 | 21.65 | 100 | 1,342 | 208 | 230 | 1,500 | 131.0 | 133 | 27.56 | ..... | 23.62 | 2,300 | 86.8 | 9.6 | 160 | .00629 |
| 18 | | do. | Same surface. | 2 | 60 | 24.65 | 150 | 2,013 | 292 | 313 | 1,960 | 144.0 | 159 | 27.56 | ..... | 23.62 | 2,460 | 89.3 | 8.5 | 156 | .00569 |
| 19 | | do. | do. | 2 | 60 | 24.65 | 200 | 2,684 | 352 | 426 | 1,945 | 181.0 | 169 | 27.56 | ..... | 23.62 | 2,300 | 83.5 | 9.9 | 170 | .00531 |
| 20 | | do. | do. | 2 | 60 | 24.65 | 250 | 3,355 | 390 | 464 | 2,225 | 175.2 | 196 | 27.56 | ..... | 23.62 | 2,276 | 82.6 | 12.1 | 168 | .00471 |
| 21 | | do. | Same as No. 15. | 2 | 40 | 16.40 | 225 | 3,020 | 214 | 318 | 2,015 | 121.0 | 202 | 27.56 | ..... | 23.62 | 2,000 | 72.6 | 15.4 | 142 | .00446 |
| 22 | | do. | Same surface. | 2 | 80 | 32.80 | 225 | 3,020 | 333 | 372 | 2,800 | 119.0 | 216 | 27.56 | ..... | 23.62 | 2,025 | 73.5 | 13.5 | 139 | .00446 |
| 23 | | do. | do. | 2 | 80 | 32.80 | 225 | 3,020 | 410 | 481 | 3,865 | 106.0 | 370 | 27.56 | ..... | 23.62 | 2,090 | 75.9 | 22.9 | 139 | .00415 |

| | | | | | | | | | | | | | | | | | | | |
|----|-----|-----------------|---|----|-------|-----|-------|-----|-----|-------|-------|-----|-------|-------|-------|------|------|-----|--------|
| 20 | do. | Same as No. 19. | 2 | 60 | 24.65 | 225 | 3,020 | 337 | 438 | 3,005 | 122.0 | 261 | 27.56 | 23.62 | 2,300 | 83.5 | 28.9 | 143 | .00493 |
| 21 | do. | Same surface. | 2 | 60 | 24.65 | 225 | 3,020 | 419 | 475 | 3,690 | 113.3 | 310 | 27.56 | 23.62 | 2,380 | 86.4 | 11.7 | 146 | .00563 |
| 22 | do. | Same as No. 13, | 2 | 60 | 24.65 | 175 | 2,348 | 290 | 327 | 4,225 | 68.8 | 368 | 27.89 | 25.19 | 2,300 | 82.5 | 17.6 | 129 | .00501 |
| | | noble fir. | | | | | | | | | | | | | | | | | |
| 25 | do. | Same as No. 25. | 2 | 40 | 16.40 | 175 | 2,348 | 205 | 267 | 1,955 | 104.8 | 171 | 27.38 | 24.07 | 2,280 | 83.3 | 22.3 | 152 | .00532 |
| 27 | do. | Same as No. 26. | 2 | 60 | 24.65 | 175 | 2,348 | 296 | 342 | 2,900 | 102.0 | 254 | 27.38 | 24.07 | 2,280 | 83.3 | 18.2 | 145 | .00511 |
| 28 | do. | Same as No. 27. | 2 | 80 | 32.80 | 175 | 2,348 | 374 | 427 | 3,500 | 106.8 | 312 | 27.38 | 24.07 | 2,240 | 81.9 | 28.7 | 155 | .00485 |

¹ For conditions of cooking see Table 32.

² No. 29 was run on a coarse-grit stone.

TABLE 24.—Grinder runs on white pine.¹

| Run No. | Preliminary treatment of wood. | Stone. | | Number of pockets used. | Pressure on 14-inch cylinder. | Pressure per square inch of pocket area. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton of bone-dry pulp in 24 hours. | Solid rossed wood ground in 24 hours. | Weight per cubic foot of bone-dry wood. | Average diameter of wood. | Moisture in wood. | Bone-dry pulp per 100 cubic feet solid rossed wood. | Efficiency of conversion. | Screenings per 100 cubic feet solid rossed wood. | Average temperature of grinding. | Horsepower divided by pressure × speed. |
|---------|--------------------------------|---------------------------|---------------------------|-------------------------|-------------------------------|--|-------------------------|-------------------|--------------------------------|--------------------------------|----------------------------|--|---------------------------------------|---|---------------------------|-------------------|---|---------------------------|--|----------------------------------|---|
| | | Kind of burr. | Surface. | | Lbs. per sq. in. | Lbs. | | Ft. per minute. | | | Tons. | | | | Inches. | P. ct. | Lbs. | | P. ct. | Lbs. | ° F. |
| 1 | ..... | Diamond point, 6 to inch. | Same as No. 26 white fir. | 2 | 40 | 16.4 | 175 | 2,372 | 248 | *305 | 2,035 | 122.0 | 218 | 20.40 | 51 | 61.74 | 1,870 | 91.7 | 4.1 | 150 | 0.00638 |
| 2 | ..... | do. | Same surface. | 2 | 60 | 24.65 | 175 | 2,372 | 347 | 391 | 3,427 | 101.0 | 373 | 20.40 | 51 | 61.74 | 1,840 | 90.2 | 8.8 | 139 | .00594 |
| 3 | ..... | do. | do. | 2 | 80 | 32.8 | 175 | 2,372 | 451 | 489 | 5,010 | 90.0 | 534 | 20.40 | 63 | 61.74 | 1,880 | 92.1 | 11.2 | 142 | .00581 |
| 4 | ..... | do. | do. | 2 | 100 | 41.0 | 175 | 2,372 | 527 | 586 | 6,800 | 76.9 | 742 | 20.40 | 63 | 61.74 | 1,880 | 90.7 | 10.0 | 133 | .00543 |
| 5 | ..... | do. | do. | 2 | 60 | 24.65 | 100 | 1,355 | 226 | 250 | 2,035 | 111.0 | 211 | 20.40 | 51 | 61.74 | 1,930 | 94.6 | 11.6 | 144 | .00676 |
| 6 | ..... | do. | do. | 2 | 60 | 24.65 | 150 | 2,033 | 320 | 362 | 3,175 | 103.7 | 350 | 20.40 | 51 | 61.74 | 1,812 | 89.0 | 7.6 | 146 | .00656 |
| 7 | ..... | do. | do. | 2 | 60 | 24.65 | 200 | 2,710 | 458 | 491 | 4,670 | 98.1 | 480 | 20.40 | 51 | 61.74 | 1,947 | 95.5 | 6.7 | 147 | .00685 |
| 8 | ..... | do. | do. | 2 | 60 | 24.65 | 250 | 3,388 | 498 | 536 | 5,200 | 95.5 | 532 | 20.40 | 51 | 61.74 | 1,952 | 95.8 | 6.7 | 145 | .00594 |
| 9 | Steamed. | do. | do. | 2 | 40 | 16.4 | 225 | 3,049 | 302 | 354 | 2,330 | 123.7 | 318 | 20.10 | 51 | 57.20 | 1,470 | 73.1 | 9.8 | 153 | .00604 |
| 10 | do. | do. | Same as No. 34 white fir. | 2 | 60 | 24.65 | 225 | 3,049 | 400 | 456 | 3,600 | 111.0 | 489 | 20.10 | 51 | 57.20 | 1,470 | 73.1 | 15.4 | 153 | .00531 |
| 11 | do. | do. | do. | 2 | 80 | 32.8 | 225 | 3,049 | 440 | 531 | 4,245 | 108.4 | 552 | 20.10 | 51 | 57.20 | 1,535 | 76.4 | 22.15 | 139 | .00460 |
| 12 | do. | do. | do. | 2 | 100 | 41.0 | 225 | 3,049 | 517 | 573 | 4,675 | 110.7 | 669 | 20.10 | 51 | 57.20 | 1,400 | 69.6 | 30.6 | 138 | .00414 |

¹ For conditions of steaming see Table 32.

TABLE 25.—Grinder runs on *Engelmann spruce* (Montana).¹

| Run No. | Preliminary treatment of wood. | Stone. | | Number of pockets used. | Pressure on 14-inch cylinder. | Pressure per square inch of pocket area. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton bone-dry pulp in 24 hours. | Solid ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | Bone-dry pulp per 100 cubic feet solid ground wood. | Efficiency of conversion. | Screenings per 100 cubic feet solid ground wood. | Average temperature of grinding. | Horsepower divided by pressure \times speed. |
|---------|--------------------------------|--|-----------------------------|-------------------------|-------------------------------|--|-------------------------|-------------------|--------------------------------|--------------------------------|----------------------------|---|---------------------------|--------------------------------------|---------------------------|-------------------|---|---------------------------|--|----------------------------------|--|
| | | Kind of burr. | Surface. | | Lbs. per sq. in. | Lbs. | | Ft. per minute. | | | Tons. | | Cu. ft. | Lbs. | Inches. | | P. ct. | Lbs. | P. ct. | Lbs. | ° F. |
| 1 | | Spiral, cut 12 to inch, straight, cut 3 to inch. | Same as No. 12 Alpine fir. | 2 | 60 | 24.65 | 100 | 1,355 | 216 | 264 | 2.730 | 79.1 | 246 | 24.90 | 9 $\frac{1}{2}$ | 44.00 | 2,220 | 89.1 | 13.4 | 137 | 0.00646 |
| 2 | |do..... | Same surface..... | 2 | 60 | 24.65 | 150 | 2,033 | 283 | 328 | 4.260 | 66.4 | 368 | 24.90 | 9 | 44.00 | 2,315 | 92.9 | 12.5 | 132 | .00565 |
| 3 | |do..... |do..... | 2 | 60 | 24.65 | 200 | 2,710 | 381 | 446 | 5.640 | 67.6 | 486 | 24.90 | 8 $\frac{1}{2}$ | 44.00 | 2,315 | 92.9 | 16.4 | 129 | .00570 |
| 4 | |do..... |do..... | 2 | 60 | 24.65 | 250 | 3,388 | 455 | 539 | 7.050 | 64.5 | 611 | 24.90 | 9 $\frac{1}{2}$ | 44.00 | 2,300 | 92.4 | 9.4 | 130 | .00545 |
| 5 | |do..... |do..... | 2 | 40 | 16.40 | 225 | 3,049 | 281 | 333 | 3.695 | 76.1 | 328 | 24.90 | 9 | 44.00 | 2,255 | 90.5 | 4.2 | 135 | .00666 |
| 6 | |do..... |do..... | 2 | 60 | 24.65 | 225 | 3,049 | 422 | 461 | 6.140 | 67.3 | 554 | 24.90 | 9 | 44.00 | 2,220 | 89.1 | 8.5 | 134 | .00561 |
| 7 | |do..... |do..... | 2 | 80 | 32.80 | 225 | 3,049 | 484 | 534 | 9.280 | 52.2 | 770 | 24.90 | 8 $\frac{1}{2}$ | 44.00 | 2,413 | 96.8 | 16.5 | 124 | .00534 |
| 8 | Steamed. |do..... | Stone dressed..... | 2 | 40 | 16.40 | 175 | 2,371 | 203 | 233 | 2.580 | 78.7 | 252 | 24.90 | 10 $\frac{1}{2}$ | 44.00 | 2,050 | 82.4 | 20.2 | 122 | .00322 |
| 9 | |do..... | Same surface..... | 2 | 60 | 24.65 | 175 | 2,371 | 278 | 332 | 3.500 | 79.5 | 328 | 24.90 | 10 | 44.00 | 2,130 | 85.5 | 48.2 | 114 | .00475 |
| 10 | |do..... |do..... | 2 | 80 | 32.80 | 175 | 2,371 | 326 | 378 | 4.565 | 71.3 | 476 | 24.90 | 8 $\frac{1}{2}$ | 44.00 | 1,915 | 76.9 | 104.0 | 113 | .00420 |
| 11 | |do..... |do..... | 2 | 40 | 16.40 | 175 | 2,371 | 240 | 278 | 3.645 | 65.9 | 302 | 24.90 | 9 $\frac{1}{2}$ | 44.00 | 2,405 | 96.6 | 9.7 | 132 | .00618 |
| 12 | |do..... |do..... | 2 | 60 | 24.65 | 175 | 2,371 | 330 | 365 | 5.655 | 58.5 | 401 | 24.90 | 10 | 44.00 | 2,200 | 92.0 | 19.1 | 128 | .00565 |
| 13 | |do..... |do..... | 2 | 80 | 32.80 | 175 | 2,371 | 399 | 450 | 6.880 | 58.0 | 651 | 24.90 | 9 $\frac{1}{2}$ | 44.00 | 2,110 | 84.8 | 26.5 | 120 | .00514 |
| 14 | | Spiral, cut 8 to inch, straight, cut 10 to inch. | Same as No. 10 lowland fir. | 2 | 40 | 16.40 | 175 | 2,348 | 204 | 228 | 2.370 | 86.0 | 222 | 23.86 | 8 | 46.79 | 2,140 | 89.7 | 4.5 | 137 | .00550 |
| 15 | |do..... | Same surface..... | 2 | 60 | 24.65 | 175 | 2,348 | 294 | 331 | 4.000 | 73.5 | 360 | 23.86 | 8 | 46.79 | 2,220 | 93.1 | 10.7 | 130 | .00507 |
| 16 | |do..... |do..... | 2 | 80 | 32.80 | 175 | 2,348 | 313 | 354 | 4.840 | 64.6 | 402 | 23.86 | 8 $\frac{1}{2}$ | 46.79 | 2,405 | 10.08 | 12.9 | 131 | .00406 |
| 17 | |do..... |do..... | 2 | 60 | 24.65 | 100 | 1,342 | 187 | 201 | 2.525 | 74.0 | 223 | 23.86 | 10 | 46.79 | 2,275 | 95.4 | 11.3 | 136 | .00564 |
| 18 | |do..... |do..... | 2 | 60 | 24.65 | 150 | 2,013 | 259 | 303 | 3.380 | 76.6 | 306 | 23.86 | 7 $\frac{1}{2}$ | 46.79 | 2,215 | 92.9 | 7.8 | 138 | .00522 |
| 19 | |do..... |do..... | 2 | 60 | 24.65 | 200 | 2,684 | 333 | 370 | 4.880 | 68.3 | 437 | 23.86 | 7 $\frac{1}{2}$ | 46.79 | 2,230 | 93.5 | 4.3 | 131 | .00503 |

¹ For conditions of cooking see Table 32.

TABLE 26. *Grinder runs on Engelmann spruce (Colorado).*¹

| Run No. | Preliminary treatment of wood. | Stone. | Kind of burr. | Surface. | Number of pockets used. | Pressure on 14-inch cylinder. | | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton bone-dry pulp in 24 hours. | Solid tressed wood ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | Bone-dry pulp per 100 cubic feet solid tressed wood. | Efficiency of conversion. | Screenings per 100 cubic feet solid tressed wood bone dry. | Average temperature of grinding. | Horsepower divided by pressure \times speed. |
|---------|--------------------------------|--------|--|---------------------------|-------------------------|-------------------------------|-------|-------------------------|-------------------|--------------------------------|--------------------------------|----------------------------|---|--|--------------------------------------|---------------------------|-------------------|--|---------------------------|--|----------------------------------|--|
| | | | | | | Lbs. per sq. in. | Lbs. | | | | | | | | | | | | | | | |
| 1 | | | Spiral, cut 8 to 14 inch; straight, cut 10 to 12 inch. | Same as No. 54 tamarack. | 12 | 40 | 16.4 | 225 | 3,069 | 299 | 348 | 2,700 | 110.8 | 272 | 20.48 | 57 | 59.20 | 1,980 | 96.5 | 12.35 | 140 | 0.00594 |
| 2 | | | do. | Same surface. | 12 | 60 | 24.65 | 225 | 3,069 | 411 | 457 | 4,535 | 90.6 | 465 | 20.48 | 57 | 59.20 | 1,951 | 95.2 | 13.30 | 136 | .00543 |
| 3 | | | do. | do. | 12 | 80 | 32.8 | 225 | 3,069 | 478 | 538 | 5,000 | 85.4 | 577 | 20.48 | 58 | 59.20 | 1,940 | 94.6 | 16.20 | 150 | .00475 |
| 4 | | | do. | Same as No. 3 | 12 | 60 | 24.65 | 175 | 2,387 | 323 | 358 | 3,230 | 100.0 | 343 | 20.48 | 54 | 59.20 | 1,882 | 91.9 | 13.30 | 144 | .00548 |
| 5 | | | do. | white fir. | 3 | 60 | 24.65 | 100 | 1,355 | 257 | 300 | 3,325 | 77.3 | 310 | 22.22 | 6 | 57.30 | 2,150 | 96.7 | 11.10 | 137 | .00739 |
| 6 | | | do. | balsam. | 3 | 60 | 24.65 | 150 | 2,033 | 383 | 441 | 4,735 | 80.9 | 457 | 22.22 | 6 | 57.30 | 2,073 | 93.2 | 10.80 | 133 | .00765 |
| 7 | | | do. | Same surface. | 3 | 60 | 24.65 | 200 | 2,710 | 510 | 589 | 6,535 | 78.1 | 602 | 22.22 | 6 | 57.30 | 1,972 | 88.8 | 6.70 | 138 | .00763 |
| 8 | | | do. | do. | 3 | 60 | 24.65 | 250 | 3,388 | 590 | 665 | 7,360 | 76.1 | 700 | 22.22 | 6 | 57.30 | 1,940 | 87.3 | 6.60 | 132 | .00670 |
| 9 | | | do. | Same as No. 7 | 12 | 40 | 16.4 | 175 | 2,372 | 231 | 263 | 2,555 | 90.4 | 243 | 21.17 | 6 | 58.26 | 2,105 | 99.5 | 6.8 | 140 | .00595 |
| 10 | | | do. | white fir. | 12 | 60 | 24.65 | 175 | 2,372 | 304 | 362 | 4,075 | 74.6 | 383 | 21.17 | 6 | 58.26 | 2,127 | ..... | 8.9 | 136 | .00520 |
| 11 | | | do. | do. | 12 | 80 | 32.8 | 175 | 2,372 | 339 | 420 | 4,745 | 71.5 | 438 | 21.17 | 6 | 58.26 | 2,165 | ..... | 11.4 | 131 | .00436 |
| 12 | | | do. | do. | 12 | 100 | 41.0 | 175 | 2,372 | 416 | 493 | 6,215 | 67.0 | 508 | 21.17 | 6 | 58.26 | 2,080 | 98.4 | 9.7 | 139 | .00428 |
| 13 | Steamed. | | do. | do. | 12 | 40 | 16.4 | 212 | 2,870 | 235 | 270 | 2,117 | 111.0 | 264 | 21.17 | 6 | 58.26 | 1,633 | 75.9 | 17.2 | 132 | .00499 |
| 14 | do. | | do. | do. | 12 | 60 | 24.65 | 223 | 3,020 | 308 | 373 | 3,490 | 97.4 | 334 | 21.17 | 6 | 58.26 | 1,890 | 80.4 | 19.2 | 132 | .00413 |
| 15 | do. | | do. | do. | 12 | 80 | 32.8 | 207 | 2,805 | 311 | 411 | 3,590 | 95.0 | 395 | 21.17 | 6 | 58.26 | 1,829 | 86.0 | 24.2 | 122 | .00370 |
| 16 | do. | | do. | do. | 12 | 100 | 41.0 | 222 | 3,007 | 414 | 490 | 4,525 | 91.4 | 525 | 21.17 | 6 | 58.26 | 1,792 | 84.5 | 23.8 | 129 | .00336 |
| 17 | do. | | do. | do. | 12 | 60 | 24.65 | 200 | 2,710 | 306 | 350 | 3,125 | 97.8 | 348 | 21.17 | 6 | 58.26 | 1,702 | 84.8 | 15.7 | 129 | .00458 |
| 18 | do. | | do. | do. | 12 | 60 | 24.65 | 195 | 2,642 | 307 | 372 | 3,360 | 86.3 | 375 | 21.17 | 6 | 58.26 | 1,900 | 89.8 | 15.3 | 126 | .00470 |
| 19 | do. | | do. | Same as No. 35 white fir. | 12 | 70 | 28.70 | 225 | 3,020 | 368 | 479 | 4,840 | 76.0 | 488 | 21.17 | 6 | 58.26 | 1,980 | 93.6 | 12.8 | 135 | .00425 |

¹ For cooking conditions see Table 32.

TABLE 27.—Grinder runs on *Silka spruce*.¹

| Run No. | Preliminary treatment of wood. | Stone. | | Number of pockets used. | Pressure on 14-inch cylinder. | Pressure per square inch. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton bone-dry pulp in 24 hours. | Solid ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | Bone-dry pulp per 100 cubic feet solid ground wood. | Efficiency of conversion. | Screenings per 100 cubic feet solid ground wood bone-dry. | Average temperature of grinding. | Horsepower divided by pressure × speed. |
|---------|--------------------------------|--------------------------------|--------------------------------------|-------------------------|-------------------------------|---------------------------|-------------------------|-------------------|--------------------------------|--------------------------------|----------------------------|---|---------------------------|--------------------------------------|---------------------------|-------------------|---|---------------------------|---|----------------------------------|---|
| | | Kind of burr. | Surface. | | Lbs. per sq. in. | Lbs. | | Ft. per minute. | | | Tons. | | | | Inches. | P. ct. | Lbs. | P. ct. | | ° F. | |
| 1 | ..... | Straight, cut 3 to 12 to inch. | Same as for western larch No. 2. | 3 | 30 | 12.3 | 225 | 2,085 | 307 | 358 | 2.225 | 137.8 | 214.5 | 25.38 | (2) | 16.66 | 2,075 | 81.8 | 12.88 | 174.2 | 0.00809 |
| 2 | ..... | ..... | Stone dressed | 3 | 20 | 8.2 | 250 | 3,427 | 217 | 245 | 1.840 | 118.0 | 188.4 | 24.60 | (2) | 19.07 | 1,932 | 79.4 | 8.59 | 154.0 | .00772 |
| 3 | ..... | ..... | Same surface | 3 | 40 | 16.4 | 250 | 3,427 | 308 | 407 | 4.550 | 81.0 | 435.0 | 24.60 | (2) | 19.07 | 2,005 | 85.1 | 13.87 | 145.3 | .00554 |
| 4 | ..... | ..... | do. | 2 | 60 | 24.65 | 250 | 3,427 | 510 | 586 | 7.050 | 72.4 | 680.0 | 24.60 | (2) | 19.07 | 2,075 | 84.3 | 13.48 | 136.3 | .00402 |
| 5 | Boiled | Straight, cut 8 to inch. | Same as No. 5 birch | 2 | 40 | 16.4 | 225 | 3,080 | 197 | 245 | 1.500 | 131.2 | 164.0 | 23.60 | (2) | 24.00 | 1,830 | 77.5 | 20.30 | 107.0 | .00390 |
| 6 | do. | ..... | Same surface | 2 | 60 | 24.65 | 225 | 3,080 | 256 | 329 | 1.985 | 129.0 | 234.0 | 23.60 | (2) | 24.00 | 1,698 | 71.9 | 36.00 | 109.0 | .00337 |
| 7 | do. | Straight, cut 3 to inch. | do. | 2 | 80 | 32.8 | 225 | 3,080 | 331 | 404 | 2.920 | 113.3 | 333.0 | 23.60 | (2) | 24.00 | 1,750 | 74.1 | 44.20 | 103.1 | .00328 |
| 8 | ..... | ..... | Stone dressed | 3 | 60 | 24.65 | 100 | 1,306 | 293 | 313 | 2.095 | 125.7 | 208.0 | 23.40 | (2) | 22.60 | 2,005 | 85.7 | 14.37 | 134.9 | .00780 |
| 9 | ..... | ..... | Same surface | 3 | 60 | 24.65 | 150 | 2,049 | 346 | 401 | 3.107 | 111.2 | 236.0 | 23.40 | (2) | 22.60 | 2,100 | 89.7 | 13.51 | 147.2 | .00685 |
| 10 | ..... | ..... | do. | 3 | 60 | 24.65 | 200 | 2,732 | 468 | 505 | 4.340 | 108.0 | 407.0 | 23.40 | (2) | 22.60 | 2,130 | 91.0 | 16.70 | 144.0 | .00695 |
| 11 | ..... | ..... | do. | 3 | 60 | 24.65 | 250 | 3,415 | 560 | 651 | 5.340 | 105.0 | 494.0 | 23.40 | (2) | 22.60 | 2,160 | 92.3 | 13.17 | 142.9 | .00665 |
| 12 | ..... | ..... | Same as No. 18 California lodgepole. | 2 | 40 | 16.4 | 225 | 3,073 | 222 | 280 | 1.047 | 212.0 | 104.0 | 23.00 | (2) | 22.60 | 2,008 | 87.4 | 12.70 | 155.8 | .00440 |
| 13 | ..... | ..... | Same surface | 2 | 60 | 24.65 | 225 | 3,073 | 313 | 414 | 2.005 | 156.0 | 200.0 | 23.00 | (2) | 22.60 | 2,000 | 87.0 | 10.60 | 155.0 | .00413 |
| 14 | ..... | ..... | do. | 2 | 80 | 32.8 | 225 | 3,073 | 409 | 512 | 2.917 | 140.2 | 292.0 | 23.00 | (2) | 22.60 | 1,992 | 86.6 | 20.70 | 149.3 | .00405 |
| 15 | ..... | ..... | do. | 2 | 100 | 41.0 | 225 | 3,073 | 433 | 515 | 3.005 | 144.0 | 310.0 | 23.00 | (2) | 22.60 | 1,945 | 84.5 | 16.29 | 154.3 | .00344 |
| 16 | Steamed | ..... | Same as No. 47 tamarack. | 3 | 60 | 24.65 | 200 | 2,732 | 414 | 493 | 1.107 | 374.0 | 126.7 | 23.00 | (2) | 22.60 | 1,750 | 76.1 | 25.83 | 178.4 | .00614 |
| 17 | do. | ..... | Same surface | 3 | 60 | 24.65 | 200 | 2,732 | 382 | 454 | 1.502 | 240.0 | 197.0 | 23.00 | (2) | 22.60 | 1,618 | 70.3 | 31.27 | 138.3 | .00566 |
| 18 | ..... | ..... | do. | 3 | 60 | 24.65 | 189 | 2,580 | 368 | 432 | .920 | 400.0 | 94.2 | 23.00 | (2) | 22.60 | 1,952 | 84.9 | 18.50 | 176.7 | .00578 |
| 19 | ..... | ..... | Stone dressed | 2 | 80 | 32.8 | 225 | 3,069 | 458 | 541 | 4.495 | 102.0 | 435.0 | 23.00 | (2) | 22.60 | 2,065 | 89.9 | 32.50 | 166.0 | .00455 |

² Split wood.¹ For cooking conditions see Table 32.

TABLE 28.—Grinder runs on white birch.¹

| Run No. | Preliminary treatment of wood. | Stone. | | Number of pockets used. | Pressure on 14-inch cyl-inder. | Pressure per square inch of pocket area. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton bone-dry pulp in 24 hours. | Solid rossed wood ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | Bone-dry pulp per 100 cubic feet solid rossed wood. | Efficiency of conversion. | Screenings per 100 cubic feet solid rossed wood. | Average temperature of grinding. | Horsepower divided by pressure \times speed. |
|---------|--------------------------------|--|--|-------------------------|--------------------------------|--|-------------------------|-------------------|--------------------------------|--------------------------------|----------------------------|---|---------------------------------------|--------------------------------------|---------------------------|-------------------|---|---------------------------|--|----------------------------------|--|
| | | Kind of burr. | Surface. | | | | | | | | | | | | | | | | | | |
| 1 | Steamed | Straight, cut 3 to inch; spiral, cut 12 to inch. | Same as for laminarack No. 25. | 3 | 40 | 16.4 | 200 | 2,762 | 229.0 | 285 | 3.455 | 66.3 | 208.0 | 36.37 | 5 $\frac{1}{2}$ | 39.23 | 2,580 | 71.0 | 6.70 | 136.9 | 0.00505 |
| 2 | | do. | Same as for red fir No. 4. | 3 | 30 | 12.3 | 225 | 3,085 | 338.0 | 370 | 2.980 | 113.2 | 200.0 | 34.62 | 8 $\frac{1}{2}$ | 37.34 | 2,980 | 86.0 | 6.51 | 176.0 | .00890 |
| 3 | Boiled | Straight, cut 8 to inch. | Same as poplar No. 5. | 2 | 40 | 16.4 | 225 | 3,080 | 198.0 | 238 | 2.580 | 76.7 | 226.0 | 32.18 | 6 $\frac{3}{4}$ | 38.60 | 2,286 | 71.1 | 11.57 | 110.0 | .00392 |
| 4 | do. | do. | Same surface. | 2 | 60 | 24.65 | 225 | 3,080 | 286.0 | 352 | 4.013 | 71.2 | 322.0 | 32.18 | 6 $\frac{3}{4}$ | 38.60 | 2,492 | 77.5 | 9.79 | 125.0 | .00376 |
| 5 | do. | do. | do. | 2 | 80 | 32.8 | 225 | 3,080 | 334.0 | 415 | 4.475 | 71.6 | 355.0 | 32.18 | 7 $\frac{1}{2}$ | 38.60 | 2,520 | 78.4 | 12.60 | 130.6 | .00331 |
| 6 | | Spiral, cut 8 to inch; straight, cut 10 to inch. | Same as for No. 21 California lodgepole. | 2 | 40 | 16.4 | 100 | 1,364 | 138.8 | 150 | .718 | 193.1 | 52.4 | 34.15 | 8 | 40.50 | 2,740 | 80.3 | 10.80 | 167.1 | .00620 |
| 7 | | do. | Same surface. | 2 | 60 | 24.65 | 100 | 1,364 | 191.0 | 222 | 1.218 | 157.0 | 85.4 | 34.15 | 8 | 40.50 | 2,855 | 83.6 | 4.61 | 163.6 | .00568 |
| 8 | | do. | do. | 2 | 80 | 32.8 | 100 | 1,364 | 259.0 | 294 | 1.997 | 129.7 | 130.0 | 34.15 | 7 $\frac{1}{2}$ | 40.50 | 3,075 | 90.0 | 5.22 | 163.9 | .00580 |
| 9 | | do. | do. | 2 | 100 | 41.0 | 100 | 1,364 | 287.0 | 322 | 2.550 | 112.6 | 161.3 | 34.15 | 8 $\frac{1}{2}$ | 40.50 | 3,120 | 91.5 | 8.01 | 161.2 | .00513 |

¹ For cooking conditions see Table 32.

TABLE 29.—Grinder runs on aspen.¹

| Run No. | Preliminary treatment of wood. | Stone. | | Number of pockets used. | Pressure on 14-inch cylinder. | Pressure per square inch of pocket area. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton bone-dry pulp in 24 hours. | Solid ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | Bone-dry pulp per 100 cubic feet solid ground wood. | Efficiency of conversion. | Screenings per 100 cubic feet solid ground wood. | Average temperature of grinding. | Horsepower divided by pressure × speed. |
|---------|--------------------------------|--|------------------------|-------------------------|-------------------------------|--|-------------------------|-------------------|--------------------------------|--------------------------------|----------------------------|---|---------------------------|--------------------------------------|---------------------------|-------------------|---|---------------------------|--|----------------------------------|---|
| | | Kind of burr. | Surface. | | Lbs. per sq. in. | Lbs. | | ft. per minute. | | | Tons. | | | | Inches. | P. ct. | Lbs. | P. ct. | | | ° F. |
| 1 | Steamed... | Straight, cut 3 to inch, spiral, cut 12 to inch. | Stone dressed... | 3 | 30 | 16.4 | 200 | 2,762 | 209.3 | 266 | 3.300 | 63.4 | 333.0 | 24.86 | 6½ | 51.95 | 1,870 | 75.2 | 6.13 | 133.3 | 0.00461 |
| 2 | ..... | ..... | Same as red fir No. 3. | 3 | 30 | 12.3 | 225 | 3,035 | 325.0 | 374 | 2.340 | 139.0 | 210.0 | 26.61 | 5½ | 43.28 | 2,227 | 83.8 | 6.86 | 175.7 | .00856 |
| 3 | Boiled... | Straight, cut 8 to inch. | Stone dressed... | 2 | 40 | 16.4 | 225 | 3,080 | 179.0 | 209 | 2.824 | 63.4 | 321.0 | 25.33 | 6½ | 42.88 | 1,756 | 69.4 | 7.41 | 108.5 | .00354 |
| 4 | do..... | do..... | Same surface... | 2 | 60 | 24.65 | 225 | 3,080 | 240.0 | 290 | 3.383 | 70.8 | 365.0 | 25.33 | 7½ | 42.88 | 1,856 | 73.3 | 9.01 | 124.1 | .00316 |
| 5 | do..... | do..... | do..... | 2 | 80 | 32.8 | 225 | 3,080 | 277.0 | 318 | 4.590 | 60.5 | 479.0 | 25.33 | 7½ | 42.88 | 1,920 | 75.9 | 10.87 | 116.0 | .00274 |
| 6 | do..... | Straight, cut 8 to inch, spiral, cut 10 to inch. | Same as No. 9 birch. | 2 | 40 | 16.4 | 100 | 1,364 | 137.0 | 164 | .438 | 313.0 | 40.7 | 24.00 | 5½ | 46.70 | 2,150 | 89.6 | 3.26 | 171.1 | .00612 |
| 7 | ..... | do..... | Same surface... | 2 | 60 | 24.65 | 100 | 1,364 | 198.0 | 220 | .895 | 221.0 | 80.2 | 24.00 | 5½ | 46.70 | 2,230 | 93.0 | 7.21 | 166.2 | .00589 |
| 8 | ..... | do..... | do..... | 2 | 80 | 32.8 | 100 | 1,364 | 253.0 | 294 | 1.390 | 182.0 | 128.7 | 24.00 | 5½ | 46.70 | 2,160 | 90.0 | 7.45 | 175.1 | .00565 |
| 9 | ..... | do..... | do..... | 2 | 100 | 41.0 | 100 | 1,364 | 285.0 | 324 | 1.760 | 162.0 | 166.0 | 24.00 | 6 | 46.70 | 2,115 | 88.1 | 5.00 | 164.0 | .00510 |
| 10 | ..... | do..... | do..... | 2 | 40 | 16.4 | 200 | 2,738 | 240.0 | 286 | .565 | 426.0 | 55.7 | 24.00 | 6 | 46.70 | 2,027 | 84.5 | 5.69 | 187.3 | .00336 |
| 11 | ..... | do..... | do..... | 2 | 40 | 24.65 | 200 | 2,738 | 306.0 | 267 | 1.030 | 297.0 | 98.5 | 24.00 | 6½ | 46.70 | 2,090 | 87.1 | 6.92 | 180.3 | .00455 |
| 12 | ..... | do..... | do..... | 2 | 80 | 32.8 | 200 | 2,738 | 508.0 | 573 | 2.200 | 231.0 | 200.0 | 24.00 | 6½ | 46.70 | 2,200 | 91.6 | 6.22 | 176.5 | .00568 |
| 13 | ..... | do..... | do..... | 2 | 100 | 41.0 | 200 | 2,728 | 475.0 | 535 | 2.745 | 173.0 | 246.0 | 24.00 | 7 | 46.70 | 2,222 | 92.6 | 6.18 | 170.1 | .00424 |

¹ For cooking conditions see Table 32.

TABLE 30.—Grinder runs on black gum.¹

| Run No. | Stone. | | Kind of burr. | Surface. | Number of pockets used. | Pressure on 14-inch cylinder. | Pressure per square inch of pocket area. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton bone-dry pulp in 24 hours. | Solid ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | Bone-dry pulp per 100 cubic feet solid tossed wood. | Efficiency of conversion. | Screenings per 100 cubic feet solid tossed wood. | Average temperature of grinding. | Horsepower divided by pressure \times speed. | |
|---------|--------------------------------|--------|------------------------------|-------------------------------|--|--|--|-------------------------|-------------------|--------------------------------|--------------------------------|----------------------------|---|---------------------------|--------------------------------------|---------------------------|-------------------|---|---------------------------|--|----------------------------------|--|--------|
| | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Preliminary treatment of wood. | Stone. | Spiral, cut 8 to 10 to inch. | Same as No. 21 loblolly pine. | 2 | 40 | 60 | 175 | 2,348 | 234 | 277 | 0.895 | 261.0 | 106 | 30.71 | 8 | 47.02 | 2,380 | 77.5 | 6.4 | 128 | 0.00047 | |
| 2 | | | do. | do. | do. | 2 | 60 | 24.65 | 175 | 2,348 | 322 | 370 | 1.405 | 229.0 | 106 | 30.71 | 8 | 47.02 | 2,640 | 86.0 | 7.8 | 116 | .00555 |
| 3 | | | do. | do. | do. | 2 | 80 | 32.80 | 175 | 2,348 | 421 | 465 | 2.975 | 141.7 | 225 | 30.71 | 8 | 47.02 | 2,640 | 86.0 | 6.3 | 158 | .00548 |
| 4 | | | do. | do. | do. | 2 | 60 | 24.65 | 100 | 1,342 | 220 | 253 | 1.287 | 171.0 | 100 | 30.71 | 8 | 47.02 | 2,565 | 83.6 | 2.7 | 168 | .00664 |
| 5 | | | do. | do. | do. | 2 | 60 | 24.65 | 150 | 2,013 | 287 | 315 | 1.655 | 173.3 | 128 | 30.71 | 8 | 47.02 | 2,585 | 84.2 | 4.2 | 167 | .00579 |
| 6 | | | do. | do. | do. | 2 | 60 | 24.65 | 200 | 2,684 | 376 | 422 | 2.080 | 181.0 | 159 | 30.71 | 8 | 47.02 | 2,620 | 85.4 | 1.9 | 170 | .00568 |
| 7 | | | do. | do. | do. | 2 | 60 | 24.65 | 250 | 3,355 | 422 | 466 | 2.465 | 171.0 | 193 | 30.71 | 7 | 47.02 | 2,555 | 83.1 | 2.6 | 175 | .00510 |
| 8 | | | do. | do. | do. | 2 | 60 | 24.65 | 200 | 2,684 | 395 | 444 | 5.305 | 71.4 | 392 | 30.71 | 7 | 47.02 | 2,710 | 88.2 | 2.1 | 139 | .00365 |
| 9 | | | do. | do. | do. | 2 | 60 | 24.65 | 200 | 2,684 | 323 | 380 | 4.000 | 72.3 | 359 | 28.70 | 9 | 47.00 | 2,485 | 86.6 | 5.9 | 139 | .00488 |
| 10 | | | do. | do. | do. | 2 | 60 | 24.65 | 200 | 2,684 | 305 | 378 | 3.000 | 83.4 | 317 | 28.70 | 9 | 47.00 | 2,310 | 80.5 | 4.4 | 140 | .00461 |
| 11 | | | do. | do. | do. | 2 | 40 | 16.40 | 200 | 2,684 | 241 | 279 | 2.565 | 96.1 | 218 | 28.70 | 7 | 47.00 | 2,295 | 84.0 | 2.0 | 141 | .00517 |
| 12 | | | do. | do. | do. | 2 | 80 | 32.80 | 200 | 2,684 | 358 | 469 | 4.440 | 80.7 | 371 | 28.70 | 8 | 47.00 | 2,390 | 83.7 | 6.1 | 144 | .00406 |
| 13 | | | do. | do. | do. | 2 | 60 | 24.65 | 175 | 2,318 | 294 | 370 | 3.595 | 81.7 | 278 | 31.40 | 6 | 42.07 | 2,580 | 82.2 | 5.3 | 149 | .00509 |
| 2 14 | | | do. | do. | Straight, cut 3 to 12 to inch; spiral, cut 12 to inch. | Same as No. 22 loblolly pine. Same as No. 29 loblolly pine. | 2 | 20 | 8.20 | 200 | 2,774 | 137 | 186 | 1.950 | 70.8 | 158 | 31.40 | 7 | 42.07 | 2,460 | 78.3 | 20.1 | 130 | .00603 |

² No. 14 was run on a coarse grit stone.¹ For conditions of cooking see Table 32.

TABLE 31.—*Runs on mixtures of woods.*¹

| Kind of wood. | Run No. | Stone. | | Number of pockets used. | Pressure on 14-inch cylinder. | Pressure per square inch of pocket area. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horse power per ton bone-dry pulp in 24 hours. | Solid ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | Bone-dry pulp per 100 cubic feet solid ground wood. | Efficiency of conversion. | Screenings per 100 cubic feet solid ground wood, bone-dry. | Average temperature of grinding. | Horsepower divided by pressure X speed. |
|---|---------|--|--------------------------------------|-------------------------|-------------------------------|--|-------------------------|------------------------|--------------------------------|--------------------------------|----------------------------|--|---------------------------|--------------------------------------|---------------------------|-------------------|---|---------------------------|--|----------------------------------|---|
| | | Kind of burr. | Surface. | | | | | | | | | | | | | | | | | | |
| Hemlock-spruce..... | 46-A | Straight, cut 3 to inch. | Same surface as run 45, 109-2. | 3 | Lbs. per sq. in. 50 | Lbs. 20.5 | 175 | Feet per minute. 2,450 | 392.0 | 465 | Tons. 4.275 | 91.7 | Cu. ft. 91.7 | Lbs. 24.44 | Inches. 6 1/2 | P. ct. 36.57 | Lbs. 2,088 | P. ct. 75.0 | Lbs. 11.69 | F. 152.5 | 0.00780 |
| Hemlock..... | 46-B | do. | do. | 3 | 50 | 20.5 | 175 | 2,450 | 413.0 | 466 | 4.885 | 84.6 | | | | | | | | 175.5 | .00823 |
| Spruce..... | 46-C | do. | do. | 3 | 50 | 20.5 | 175 | 2,450 | 407.0 | 466 | 4.878 | 83.5 | | | | | | | | 160.0 | .00810 |
| Hemlock-Spruce..... | 49-A | Straight, cut 3 to inch; spiral, cut 12 to inch. | Stone dressed. | 3 | 40 | 16.4 | 175 | 2,445 | 360.4 | 427 | 4.880 | 73.8 | | | | | | | | 155.0 | .00899 |
| Hemlock..... | 49-B | Spiral, cut 12 to inch. | Same surface.. | 3 | 40 | 16.4 | 175 | 2,445 | 370.0 | 426 | 4.885 | 75.7 | | | | | | | | 168.3 | .00922 |
| Jack pine-tamarack.. | 50 | Spiral, cut 8 to inch; straight, cut 10 to inch. | Same as No. 221 spruce. | 2 | 60 | 24.65 | 225 | 3,069 | 280.0 | 330 | 3.000 | 93.2 | 151 | 24.44 | 6 1/2 | 36.57 | 2,088 | 75.0 | 11.69 | 127.0 | .00370 |
| Do..... | 51 | Straight, cut 10 to inch. | Same as No. 50. | 3 | 60 | 24.65 | 225 | 3,069 | 423.0 | 489 | 3.970 | 106.5 | 282 | 24.44 | 6 1/2 | 36.57 | 1,940 | 74.4 | 9.87 | 139.0 | .00559 |
| Do..... | 52 | do. | Same as No. 51. | 3 | 60 | 24.65 | 225 | 3,069 | 400.0 | 469 | 3.940 | 101.4 | 132 | 24.44 | 6 1/2 | 36.57 | 2,150 | 77.3 | 11.78 | 142.8 | .00329 |
| Western yellow pine-Montana lodgepole pine. | 20 | Straight, cut 3 to inch; spiral, cut 12 to inch. | Same as No. 19; western yellow pine. | 3 | 40 | 16.4 | 200 | 2,728 | 384.0 | 423 | 3,940 | 97.5 | 171 | 25.03 | 7 3/8 | 26.25 | 2,247 | 91.1 | 6.06 | 136.3 | .00858 |
| Do..... | 21 | Spiral, cut 12 to inch. | Same surface.. | 3 | 40 | 16.4 | 200 | 2,728 | 382.0 | 444 | 3.800 | 100.5 | 110 | 25.03 | 7 1/2 | 26.25 | 2,220 | 90.6 | 8.09 | 146.2 | .00352 |
| Do..... | 22 | do. | do. | 3 | 40 | 16.4 | 200 | 2,728 | 368.0 | 416 | 3.535 | 104.0 | 208 | 25.03 | 8 | 26.25 | 2,230 | 89.6 | 8.68 | 146.9 | .00822 |
| Montana lodgepole pine-western larch. | 23 | do. | do. | 3 | 40 | 16.4 | 200 | 2,728 | 355.0 | 413 | 3.307 | 107.2 | 109 | 25.03 | 8 1/2 | 26.25 | 2,200 | 86.4 | 3.86 | 149.4 | .00793 |

¹ Wood received no further treatment after barking prior to grinding on a medium-grit Lombard stone.

TABLE 31.—*Runs on mixtures of woods—Continued.*

| Kind of wood. | Run No. | Stone. | | Number of pockets used. | Pressure on 14-inch cylinder. | Pressure per square inch of pocket area. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton bone-dry pulp in 24 hours. | Solid ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | Bone-dry pulp per 100 cubic feet solid roased wood. | Efficiency of conversion. | Screenings per 100 cubic feet solid roased wood, bone-dry. | Average temperature of grinding. | Horsepower divided by pressure X speed. |
|---|---------|--|----------------|-------------------------|-------------------------------|--|-------------------------|-------------------|--------------------------------|--------------------------------|----------------------------|---|---------------------------|--------------------------------------|---------------------------|-------------------|---|---------------------------|--|----------------------------------|---|
| | | Kind of burr. | Surface. | | Lbs. per sq. in. | Lbs. | | Feet per minute. | | | Tons. | | Cu. ft. | Lbs. | Inches. | P. ct. | Lbs. | P. ct. | Lbs. | ° F. | |
| Western yellow pine—Western larch. | 24 | Spiral, cut 12 to inch. | Same surface. | 3 | 40 | 16.4 | 200 | 2,728 | 389.0 | 415 | 3,280 | 118.7 | 173 | 25.03 | 9 | 26.25 | 2,198 | 84.4 | 6.14 | 159.1 | 0.00869 |
| | 25 | do. | do. | 3 | 40 | 16.4 | 200 | 2,728 | 360.0 | 401 | 3,115 | 115.7 | 126 | 27.40 | 9 | 26.25 | 2,170 | 84.2 | 6.14 | 154.8 | 0.00803 |
| Western larch—western hemlock. | 26 | do. | do. | 3 | 40 | 16.4 | 200 | 2,728 | 373.0 | 415 | 3,275 | 114.0 | 104 | 25.03 | Split. | 26.25 | 2,268 | 88.9 | 9.73 | 156.7 | 0.00833 |
| | 15 | do. | do. | 3 | 40 | 16.4 | 200 | 2,728 | 323.0 | 352 | 2,353 | 137.2 | 103 | 24.62 | Split. | 23.84 | 2,212 | 92.1 | 8.26 | 154.0 | 0.00721 |
| Western, hemlock—Sitka spruce. | 16 | do. | do. | 3 | 40 | 16.4 | 200 | 2,728 | 312.0 | 392 | 2,163 | 144.0 | 65 | 24.62 | do. | 22.26 | 2,100 | 88.5 | 9.82 | 159.2 | 0.00886 |
| | 17 | do. | do. | 3 | 40 | 16.4 | 200 | 2,728 | 347.0 | 392 | 2,348 | 148.0 | 139 | 24.62 | do. | 22.26 | 2,190 | 90.5 | 9.23 | 163.0 | 0.00774 |
| Montana lodgepole pine—western larch. | 24 | do. | do. | 3 | 40 | 16.4 | 200 | 2,728 | 377.0 | 405 | 3,235 | 116.5 | 176 | 24.37 | 73 | 24.76 | 2,180 | 84.7 | 5.99 | 151.2 | 0.00841 |
| | 25 | do. | do. | 3 | 40 | 16.4 | 200 | 2,728 | 403.0 | 458 | 3,300 | 122.1 | 229 | 24.37 | 73 | 24.76 | 2,138 | 85.1 | 2.96 | 154.8 | 0.00900 |
| California lodgepole pine—red fir. | 22 | do. | do. | 3 | 40 | 16.4 | 200 | 2,728 | 366.0 | 410 | 2,095 | 175.0 | 113 | 21.65 | Split. | 23.88 | 1,917 | 87.5 | 8.82 | 170.2 | 0.00817 |
| | 23 | do. | do. | 3 | 40 | 16.4 | 200 | 2,728 | 391.0 | 437 | 2,650 | 147.6 | 92 | 21.65 | do. | 22.63 | 2,016 | 91.6 | 7.26 | 157.3 | 0.00874 |
| Do. | 24 | do. | do. | 3 | 40 | 16.4 | 200 | 2,728 | 376.0 | 431 | 2,137 | 176.0 | 137 | 22.11 | do. | 22.63 | 1,860 | 85.2 | 7.94 | 170.1 | 0.00840 |
| | 25 | do. | do. | 3 | 40 | 16.4 | 200 | 2,728 | 377.0 | 444 | 2,270 | 166.0 | 117 | 21.65 | do. | 22.88 | 1,988 | 88.4 | 24.90 | 162.7 | 0.00842 |
| California lodgepole pine—Sitka spruce. | 23 | Spiral, cut 8 to inch; straight, cut 10 to inch. | Stone dressed. | 3 | 40 | 16.4 | 225 | 3,069 | 476.0 | 542 | 4,980 | 95.6 | 254 | 20.30 | 54 | 61.66 | 2,160 | 96.2 | 11.50 | 157.0 | 0.00945 |
| Spruce—hemlock | 63 | do. | do. | 3 | 50 | 20.5 | 225 | 3,069 | 516.0 | 592 | 4,075 | 127.0 | 179 | 24.93 | 54 | 33.55 | 2,280 | 92.1 | 12.00 | 177.0 | 0.00820 |
| Tamarack—spruce. | 54 | do. | do. | 2 | 65 | 26.6 | 225 | 3,069 | 415.0 | 503 | 4,705 | 88.2 | 185 | 30.70 | 54 | 35.13 | 2,410 | 89.4 | 13.75 | 157.0 | 0.00509 |

NOTE.—Wood for runs 50-52, inclusive, was steamed for 5 hours at 75 pounds.

TABLE 52.—*Conditions of cooking wood prior to grinding.*

| Kind of wood. | Run No. | Dura- tion of treat- ment. | Pressure of treat- ment. | Kind of wood. | Run No. | Dura- tion of treat- ment. | Pressure of treat- ment. | Kind of wood. | Run No. | Dura- tion of treat- ment. | Pressure of treat- ment. | Kind of wood. | Run No. | Dura- tion of treat- ment. | Pres- sure of treat- ment. |
|-------------------|---------|-------------------------------------|--------------------------------|---------------|------------|-------------------------------------|--------------------------------|-------------------------------------|------------|-------------------------------------|--------------------------------|-------------------------------------|------------|-------------------------------------|-------------------------------------|
| | | Hours. | Pounds. | | | Hours. | Pounds. | | | Hours. | Pounds. | | | Hours. | Pounds. |
| Balsam fir..... | 7 | 8 | 60 | Tamarack..... | 19 | 4 | 60 | Tamarack..... | 72 | 6 | 75 | Englemann spruce (Colorado)..... | 13 | 6 | 60 |
| | 15 | 5 | 75 | | 20 | 8 | 20 | | 73 | 4 | 75 | | 14 | 6 | 60 |
| | 16 | 5 | 75 | | 21 | 8 | 40 | | 74 | 3 | 75 | | 15 | 6 | 60 |
| | 17 | 5 | 75 | | 22 | 8 | 60 | | 75 | 2 | 75 | | 16 | 6 | 60 |
| | 25 | 5 | 75 | | 23 | 8 | 60 | | 76 | 1 | 75 | | 17 | 6 | 60 |
| | 26 | 5 | 75 | | 25 | 8 | 60 | Western larch..... | 1 | 8 | 60 | | 18 | 6 | 20 |
| | 27 | 5 | 75 | | 27 | 8 | 60 | | | | | | | | |
| | 28 | 5 | 75 | | 28 | 8 | 60 | Montana lodge- pole pine..... | 8 | 8 | 60 | Englemann spruce (Montana)..... | 8 | 6 | 60 |
| | 29 | 5 | 75 | | 30 | 8 | 60 | | 13 | 5 | 75 | | 10 | 6 | 60 |
| Red fir..... | 2 | 8 | 60 | | 31 | 8 | 75 | | 14 | 5 | 75 | | | | |
| | | | | | 32 | 5 | 75 | | 15 | 5 | 75 | Sitka spruce..... | 5 | 5 | 75 |
| White fir..... | 21 | 6 | 60 | | 33 | 5 | 75 | | | | | | 6 | 7 | 75 |
| | 22 | 6 | 60 | | 34 | 5 | 75 | California lodge- pole pine..... | 1 | 8 | 60 | | 16 | 12 | 75 |
| | 23 | 6 | 60 | | 35 | 5 | 75 | | | | | | 17 | 5 | 75 |
| | 24 | 6 | 60 | | 36 | 5 | 75 | Western yellow pine | 1 | 6 | 40 | Poplar..... | 1 | 8 | 60 |
| | 25 | 6 | 60 | | 37 | 5 | 75 | | 2 | 4 | 60 | | 3 | 5 | 75 |
| | 26 | 6 | 20 | | 38 | 5 | 175 | | 3 | 8 | 60 | | 4 | 5 | 75 |
| | | | | | 39 | 5 | 75 | | 9 | 12 | 5 | White birch..... | 1 | 8 | 60 |
| Amabilis fir..... | 9 | 6 | 60 | | 40 | 5 | 75 | White pine..... | 9 | 6 | 60 | | 3 | 5 | 75 |
| | 10 | 6 | 60 | | 41 | 5 | 75 | | 10 | 6 | 60 | | 4 | 5 | 75 |
| | 11 | 6 | 60 | | 42 | 5 | 75 | | 11 | 6 | 60 | Black gum..... | 9 | 6 | 30 |
| | 12 | 6 | 60 | | 43 | 5 | 75 | Jack pine..... | 25 | 2 | 40 | | 10 | 6 | 60 |
| | 13 | 6 | 60 | | 44 | 5 | 75 | | 26 | 2 | 60 | Western hemlock... | 9 | 5 | 75 |
| | 14 | 6 | 20 | | 45 | 5 | 75 | | 28 | 3 | 75 | Loblolly pine..... | 16 | 6 | 60 |
| Alpine fir..... | 9 | 6 | 60 | | 46 | 5 | 75 | Eastern hemlock... | 31 | 5 | 75 | | 17 | 6 | 60 |
| | 10 | 6 | 60 | | 47 | 5 | 5 | | 32 | 5 | 75 | | 18 | 6 | 60 |
| | 11 | 6 | 60 | | 48 | 5 | 75 | | 33 | 5 | 75 | | 19 | 6 | 60 |
| | 12 | 6 | 60 | | 49 | 5 | 75 | | 53 | 5 | 40 | | 20 | 6 | 30 |
| | | | | | 55 | 5 | 75 | | 54 | 2 | 60 | | | | |
| Lowland fir..... | 1 | 6 | 60 | | 56 | 5 | 75 | | 55 | 8 | 60 | | | | |
| | 2 | 6 | 60 | | 57 | 5 | 75 | | 60 | 5 | 75 | | | | |
| | 3 | 6 | 60 | | 58 | 5 | 75 | | 61 | 5 | 75 | | | | |
| | | | | | 59 | 5 | 75 | | 62 | 5 | 75 | | | | |
| Noble fir..... | 9 | 6 | 60 | | 60 | 5 | 75 | | 63 | 5 | 75 | | | | |
| | 10 | 6 | 60 | | 62 | 5 | 75 | | 64 | 5 | 75 | | | | |
| | 11 | 6 | 60 | | 63 | 5 | 75 | | 65 | 5 | 75 | | | | |
| | 12 | 6 | 30 | | 64 | 5 | 75 | | 66 | 5 | 75 | | | | |
| | | | | | 66 | 5 | 75 | | 67 | 5 | 75 | | | | |
| Tamarack..... | 12 | 4 | 40 | | 67 | 5 | 75 | | 68 | 5 | 75 | | | | |
| | 13 | 2 | 20 | | 69 | 5 | 75 | | 70 | 12 | 75 | | | | |
| | 14 | 2 | 40 | | 71 | 10 | 75 | | | 8 | 75 | | | | |
| | 15 | 2 | 20 | | | | | | | | | | | | |
| | 16 | 2 | 60 | | | | | | | | | | | | |
| | 17 | 4 | 20 | | | | | | | | | | | | |
| | 18 | 4 | 40 | | | | | | | | | | | | |

1 For the wood used in grinder run No. 38, tamarack, the temperature of treatment was only 255° F.

TABLE 33.—*Quality tests—balsam.*

| Grinder run No. | Paper machine run No. | Ground wood in total furnish. | Weight per ream. | Thickness. | Mullen test. | | | | Schopper tests. | | | | | | Tintometer indications. | | | | | |
|-----------------|-----------------------|-------------------------------|------------------|------------|--------------|---------|--------------------------|------------|--|------------------|------------|-------------|----------|---------|----------------------------------|---|------|--------|-------|--------|
| | | | | | Total. | Points. | Per 0.001 in. thickness. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | | Stretch. | | Breaking weight per sq. mm. sec. | Breaking length per horsepower per ton. | Red. | Green. | Blue. | Black. |
| | | | | | | | | | | Meters. | Crosswise. | Lengthwise. | Average. | Per ct. |  |  |  |  |  |  | Lengthwise. | Average. |
| 1 | 104 | 80 | 36 | 0.0039 | 17.95 | 4.60 | 0.498 | 282 | 3,055 | 2.16 | 4,008 | 1.24 | 1.70 | 1.70 | 2,295 | 32.8 | 82 | 72 | 64 | 82 |
| 2 | 103 | 80 | 33 | 0.0039 | 13.25 | 3.40 | 0.401 | 240 | 3,030 | 1.84 | 3,970 | 1.12 | 1.48 | 1.48 | 1,835 | 30.6 | 81 | 71 | 64 | 84 |
| 3 | 111 | 80 | 31 | 0.0041 | 10.40 | 2.54 | 0.336 | 246 | 2,285 | 2.18 | 2,791 | 1.16 | 1.47 | 1.47 | 1,220 | 33.8 | 87 | 76 | 67 | 70 |
| 5 | 115 | 80 | 31 | 0.00319 | 14.95 | 4.69 | 0.482 | 369 | 3,140 | 2.86 | 3,955 | 1.50 | 2.18 | 2.18 | 2,265 | 29.0 | 80 | 72 | 65 | 83 |
| 6 | 116 | 80 | 33 | 0.00348 | 14.70 | 4.22 | 0.445 | 273 | 2,908 | 3.16 | 3,689 | 1.52 | 2.34 | 2.34 | 1,970 | 30.4 | 82 | 72 | 64 | 82 |
| 7 | 242 | 80 | 30 | 0.0033 | 14.6 | 4.4 | 0.48 | 258 | 3,000 | 1.96 | 4,140 | 1.20 | 1.59 | 1.59 | 2,010 | 33.4 | 51 | 36 | 30 | 183 |
| 8 | 224 | 80 | 34 | 0.0036 | 17.2 | 4.8 | 0.51 | 366 | 3,280 | 1.96 | 4,700 | 1.28 | 1.62 | 1.62 | 2,370 | 25.1 | 73 | 64 | 57 | 106 |
| 9 | 241 | 80 | 32 | 0.0035 | 13.6 | 3.8 | 0.43 | 309 | 3,040 | 1.84 | 4,970 | 1.22 | 1.53 | 1.53 | 1,890 | 30.1 | 72 | 63 | 58 | 107 |
| 10 | 240 | 80 | 31 | 0.0034 | 12.4 | 3.5 | 0.42 | 529 | 3,210 | 1.76 | 3,980 | 1.28 | 1.52 | 1.52 | 1,780 | 36.9 | 75 | 66 | 60 | 99 |
| 11 | 225 | 80 | 32 | 0.0035 | 14.4 | 4.2 | 0.46 | 360 | 3,000 | 2.00 | 4,100 | 1.92 | 1.56 | 1.56 | 1,940 | 18.4 | 73 | 64 | 57 | 106 |
| 12 | 238 | 80 | 32 | 0.0035 | 14.8 | 4.2 | 0.46 | 360 | 3,000 | 2.00 | 4,100 | 1.92 | 1.56 | 1.56 | 1,940 | 18.4 | 73 | 64 | 57 | 106 |
| 13 | 239 | 80 | 31 | 0.0036 | 12.4 | 3.4 | 0.40 | 276 | 2,940 | 1.88 | 3,940 | 1.26 | 1.57 | 1.57 | 1,780 | 35.8 | 76 | 67 | 61 | 96 |
| 14 | 218 | 100 | 40 | 0.0037 | 14.6 | 4.0 | 0.47 | 329 | 3,050 | 2.12 | 4,200 | 1.92 | 1.70 | 1.70 | 2,000 | 27.5 | 70 | 61 | 55 | 227 |
| 15 | 270 | 100 | 45 | 0.0036 | 27.0 | 7.4 | 0.60 | 346 | 3,800 | 2.92 | 5,030 | 1.92 | 1.88 | 1.88 | 3,450 | 24.2 | 35 | 22 | 16 | 211 |
| 16 | 277 | 100 | 48 | 0.0040 | 21.0 | 7.7 | 0.65 | 267 | 3,340 | 1.80 | 4,980 | 1.80 | 1.58 | 1.58 | 3,120 | 28.7 | 42 | 26 | 21 | 224 |
| 17 | 302 | 100 | 46 | 0.0036 | 31.0 | 7.3 | 0.62 | 270 | 3,160 | 1.72 | 4,470 | 1.72 | 1.55 | 1.55 | 3,010 | 28.7 | 38 | 22 | 16 | 224 |
| 18 | 338 | 80 | 32 | 0.0036 | 14.8 | 4.1 | 0.46 | 267 | 2,900 | 2.28 | 4,010 | 1.34 | 1.81 | 1.81 | 1,940 | 32.6 | 71 | 58 | 49 | 122 |
| 19 | 339 | 80 | 34 | 0.0038 | 15.5 | 4.1 | 0.46 | 267 | 2,910 | 2.28 | 4,010 | 1.34 | 1.81 | 1.81 | 1,940 | 32.6 | 71 | 58 | 49 | 122 |
| 20 | 329 | 80 | 32 | 0.0038 | 14.5 | 3.9 | 0.45 | 285 | 3,090 | 2.28 | 4,010 | 1.34 | 1.81 | 1.81 | 1,940 | 32.5 | 75 | 61 | 50 | 114 |
| 21 | 340 | 79 | 30 | 0.0038 | 14.6 | 3.8 | 0.46 | 277 | 3,090 | 2.12 | 4,190 | 1.36 | 1.74 | 1.74 | 1,880 | 26.7 | 70 | 65 | 56 | 98 |
| 22 | 16 | 75 | 30 | 0.0028 | 6.8 | 2.4 | 0.22 | 410 | 1,080 | 2.12 | 2,410 | 1.18 | 1.83 | 1.83 | 1,580 | 26.7 | 70 | 65 | 65 | 100 |
| 24 | 741 | 80 | 34 | 0.0043 | 13.2 | 3.1 | 0.39 | 232 | 2,640 | 2.16 | 3,640 | 1.12 | 1.90 | 1.90 | 1,420 | 40.3 | 80 | 69 | 60 | 91 |
| 25 | 484 | 100 | 33 | 0.0028 | 10.8 | 2.6 | 0.32 | 322 | 2,080 | 2.96 | 3,360 | 1.32 | 2.14 | 2.14 | 1,440 | 32.6 | 79 | 69 | 64 | 88 |
| 26 | 485 | 100 | 31 | 0.0027 | 23.1 | 8.3 | 0.70 | 206 | 3,190 | 2.96 | 5,000 | 1.26 | 1.98 | 1.98 | 3,330 | 47.1 | 48 | 38 | 31 | 182 |
| 27 | 486 | 100 | 32 | 0.0027 | 17.8 | 6.6 | 0.57 | 187 | 3,210 | 2.70 | 4,820 | 1.22 | 1.69 | 1.69 | 3,390 | 50.9 | 50 | 37 | 32 | 181 |
| 28 | 481 | 100 | 33 | 0.0029 | 20.6 | 7.5 | 0.64 | 156 | 3,400 | 2.22 | 4,720 | 1.06 | 2.14 | 2.14 | 3,170 | 47.8 | 52 | 38 | 32 | 178 |
| 29 | 487 | 100 | 34 | 0.0029 | 21.2 | 7.2 | 0.62 | 165 | 3,170 | 2.86 | 4,680 | 1.40 | 2.13 | 2.13 | 3,120 | 45.9 | 52 | 39 | 32 | 177 |

1 Commercial.

TABLE 34.—Quality tests—red fir.

| Grinder run No. | Paper machine run No. | Ground wood furnish in total | Weight per ream. | Thickness. | Mullen test. | | | | Schopper tests. | | | | | | Tintometer indications. | | | |
|-----------------|-----------------------|------------------------------|------------------|------------|--------------|---------------------------|------------|--|------------------|---------|----------|---------|----------------------------------|--------------------------|-------------------------|--------|--------|--------|
| | | | | | Total. | Per 0.001 in. thick-ness. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | Stretch. | | Breaking weight per sq. mm. sec. | Breaking length per ton. | Red. | Green. | Blue. | Black. |
| | | | | | Points. | Points. | Point. | | Meters. | Meters. | Per ct. | Per ct. | Grams. | Meters. | Parts. | Parts. | Parts. | Parts. |
| 1 | 65 | 80 | 30 | 0.0040 | 8.3 | 2.08 | 0.276 | 236 | 2,156 | 3,580 | 1.14 | 0.88 | 1,108 | 44.0 | 83 | 60 | 89 | |
| 2 | 235 | 80 | 36 | 0.0035 | 18.7 | 5.4 | .52 | 242 | 2,800 | 4,140 | 1.74 | 1.48 | 2,220 | 33.0 | 44 | 30 | 203 | |
| 4 | 212 | 80 | 29 | 0.0034 | 10.4 | 3.1 | .56 | 323 | 3,110 | 5,950 | 1.36 | 1.10 | 2,030 | 25.0 | 72 | 59 | 117 | |
| 6 | 395 | 82 | 32 | 0.0037 | 17.6 | 4.8 | .55 | 382 | 3,290 | 5,930 | 1.94 | 1.08 | 2,180 | 22.0 | 64 | 52 | 47 | |
| 7 | 398 | 80 | 32 | 0.0037 | 14.5 | 3.9 | .45 | 749 | 3,170 | 5,560 | 1.48 | .88 | 2,060 | 13.0 | 64 | 49 | 42 | |
| 8 | 396 | 80 | 36 | 0.0040 | 18.0 | 4.5 | .50 | 616 | 3,080 | 5,740 | 1.80 | 1.06 | 2,220 | 14.3 | 62 | 50 | 45 | |
| 9 | 391 | 80 | 34 | 0.0041 | 12.8 | 3.1 | .38 | 680 | 2,450 | 4,790 | 1.78 | 1.28 | 1,640 | 14.0 | 60 | 48 | 42 | |
| 10 | 390 | 80 | 40 | 0.0042 | 18.8 | 4.4 | .47 | 664 | 3,190 | 5,740 | 2.20 | 1.28 | 2,240 | 14.3 | 66 | 54 | 47 | |
| 11 | 392 | 79 | 41 | 0.0046 | 16.4 | 3.6 | .40 | 527 | 2,880 | 5,530 | 1.44 | 1.02 | 2,080 | 19.9 | 70 | 55 | 48 | |
| 12 | 393 | 80 | 36 | 0.0040 | 15.4 | 3.8 | .43 | 504 | 2,790 | 5,180 | 1.48 | 1.04 | 1,880 | 18.4 | 70 | 56 | 50 | |
| 13 | 400 | 80 | 35 | 0.0040 | 14.6 | 3.6 | .42 | 436 | 3,080 | 5,480 | 1.52 | 1.04 | 2,000 | 23.3 | 65 | 51 | 45 | |
| 14 | 394 | 80 | 31 | 0.0039 | 11.0 | 2.8 | .35 | 415 | 2,600 | 4,440 | 1.16 | .90 | 1,530 | 24.3 | 71 | 58 | 51 | |
| 15 | 326 | 80 | 33 | 0.0038 | 14.6 | 3.9 | .45 | 326 | 4,360 | 3,590 | 2.54 | 1.40 | 1,760 | 24.5 | 61 | 53 | 49 | |
| 16 | 401 | 80 | 28 | 0.0034 | 12.0 | 3.5 | .43 | 247 | 2,710 | 5,300 | 1.40 | 1.04 | 1,740 | 32.0 | 65 | 54 | 50 | |
| 17 | 397 | 80 | 32 | 0.0040 | 13.2 | 3.3 | .41 | 247 | 3,050 | 5,020 | 1.70 | 1.04 | 1,37 | 39.9 | 72 | 59 | 51 | |
| 18 | 399 | 80 | 31 | 0.0039 | 9.9 | 2.5 | .32 | 265 | 2,700 | 4,440 | 1.14 | .86 | 1,480 | 42.1 | 71 | 57 | 57 | |
| 19 | cm1.8 | 75 | 34 | 0.0034 | 9.9 | 2.9 | .29 | 212 | 1,850 | 3,550 | 1.52 | .94 | 1,24 | 31.9 | 58 | 54 | 53 | |
| | 451 | 80 | 33 | 0.0043 | 10.8 | 2.5 | .33 | 256 | 2,630 | 4,150 | 2.00 | 1.08 | 1,450 | 40.1 | 70 | 55 | 51 | |

TABLE 35.—Quality tests—white fir.

| Grinder run No. | | Paper machine run No. | Ground wood in total furnish. | Weight per ream. | Thickness. | Mullen test. | | | Schooper tests. | | | | | | Tintometer indications. | | | | | | |
|-----------------|----------|-----------------------|-------------------------------|------------------|------------|--------------|---------------------------|------------|------------------|-------------|----------|------------|-------------|----------------------------------|-------------------------|--------|---------|--------|--------------------------------|----------|--------|
| | | | | | | Total. | Per 0.001 in. thick-ness. | Per pound. | Breaking length. | | | Stretch. | | Breaking weight per sq. mm. sec. | | | | | Breaking length per horsepower | | |
| | | | | | | | | | Crosswise. | Lengthwise. | Average. | Crosswise. | Lengthwise. | | | | | | | Average. | |
| | | | | Pounds. | Inch. | Points. | Points. | Point. | | Meters. | Meters. | Meters. | Per ct. | Per ct. | Per ct. | Grams. | Meters. | Parts. | Green. | Blue. | Black. |
| 1 | 459 | 80 | 36 | 0.0050 | 10.0 | 2.0 | 0.28 | 472 | 2,080 | 3,440 | 2,760 | 1.74 | 0.90 | 1.32 | 20.9 | 70 | 63 | 58 | 109 | | |
| 2 | 460 | 80 | 37 | 0.0047 | 8.8 | 1.9 | 0.24 | 448 | 2,070 | 3,390 | 2,730 | 1.62 | 1.04 | 1.33 | 25.4 | 72 | 65 | 59 | 104 | | |
| 3 | 461 | 80 | 33 | 0.0043 | 8.0 | 1.9 | 0.24 | 369 | 2,020 | 3,310 | 2,660 | 1.46 | 0.90 | 1.18 | 30.0 | 73 | 66 | 59 | 102 | | |
| 4 | 462 | 80 | 32 | 0.0040 | 6.9 | 1.7 | 0.22 | 394 | 1,980 | 3,190 | 2,580 | 1.28 | 0.88 | 1.08 | 29.7 | 75 | 66 | 59 | 100 | | |
| 5 | 463 | 80 | 37 | 0.0045 | 9.4 | 2.1 | 0.25 | 363 | 2,200 | 3,580 | 2,890 | 1.64 | 0.98 | 1.31 | 31.9 | 70 | 63 | 55 | 112 | | |
| 6 | 464 | 80 | 36 | 0.0045 | 7.4 | 1.6 | 0.21 | 407 | 1,900 | 3,100 | 2,500 | 1.10 | 0.86 | 0.98 | 29.2 | 70 | 63 | 55 | 112 | | |
| 7 | 465 | 80 | 34 | 0.0042 | 7.4 | 1.8 | 0.22 | 380 | 1,840 | 2,980 | 2,410 | 1.16 | 0.86 | 1.01 | 28.8 | 73 | 65 | 57 | 105 | | |
| 8 | 519 | 80 | 31 | 0.0038 | 9.7 | 2.6 | 0.31 | 374 | 2,160 | 4,350 | 3,260 | 1.46 | 1.00 | 1.23 | 28.2 | 71 | 63 | 57 | 109 | | |
| 9 | 520 | 80 | 36 | 0.0043 | 8.4 | 2.0 | 0.24 | 421 | 1,640 | 3,090 | 2,900 | 1.68 | 1.08 | 1.38 | 31.4 | 74 | 63 | 56 | 107 | | |
| 10 | 505 | 80 | 38 | 0.0044 | 11.7 | 2.6 | 0.31 | 300 | 2,000 | 3,790 | 2,900 | 1.44 | 0.82 | 1.13 | 31.2 | 72 | 65 | 58 | 101 | | |
| 11 | 506 | 80 | 38 | 0.0046 | 8.8 | 1.9 | 0.23 | 370 | 1,500 | 2,890 | 2,200 | 1.90 | 1.24 | 1.57 | 25.8 | 76 | 64 | 57 | 107 | | |
| 12 | 507 | 80 | 42 | 0.0042 | 16.5 | 3.9 | 0.39 | 280 | 2,380 | 4,480 | 3,430 | 2.34 | 1.44 | 1.89 | 31.4 | 81 | 71 | 63 | 85 | | |
| 13 | 508 | 80 | 42 | 0.0043 | 15.2 | 3.5 | 0.36 | 300 | 2,000 | 4,290 | 3,140 | 2.44 | 1.56 | 2.00 | 29.0 | 79 | 70 | 62 | 84 | | |
| 14 | 509 | 80 | 42 | 0.0048 | 12.4 | 2.6 | 0.30 | 290 | 1,960 | 3,460 | 2,710 | 2.00 | 1.10 | 1.55 | 39.1 | 80 | 72 | 64 | 89 | | |
| 15 | 510 | 80 | 43 | 0.0048 | 12.6 | 2.6 | 0.29 | 291 | 1,850 | 3,550 | 2,700 | 2.04 | 1.20 | 1.62 | 32.0 | 79 | 70 | 62 | 89 | | |
| 16 | 511 | 80 | 46 | 0.0050 | 12.2 | 2.4 | 0.27 | 397 | 1,880 | 3,440 | 2,660 | 1.54 | 1.18 | 1.36 | 24.8 | 72 | 64 | 57 | 107 | | |
| 17 | 512 | 80 | 41 | 0.0046 | 11.8 | 2.5 | 0.29 | 345 | 1,900 | 3,610 | 2,800 | 1.76 | 1.10 | 1.43 | 28.0 | 74 | 64 | 59 | 103 | | |
| 18 | 513 | 80 | 46 | 0.0054 | 11.9 | 2.2 | 0.26 | 328 | 1,730 | 3,240 | 2,480 | 1.46 | 1.06 | 1.26 | 29.1 | 76 | 67 | 60 | 97 | | |
| 19 | 514 | 80 | 30 | 0.0038 | 6.2 | 1.7 | 0.21 | 358 | 1,650 | 2,860 | 2,200 | 1.16 | 0.82 | 0.99 | 30.0 | 76 | 65 | 59 | 100 | | |
| 20 | 517 | 100 | 50 | 0.0042 | 25.2 | 6.0 | 0.50 | 240 | 2,640 | 5,680 | 4,160 | 2.04 | 1.22 | 1.62 | 33.7 | 46 | 33 | 28 | 193 | | |
| 21 | 527 | 100 | 38 | 0.0033 | 18.0 | 5.4 | 0.47 | 242 | 2,380 | 3,200 | 2,790 | 1.56 | 1.04 | 1.30 | 33.2 | 49 | 36 | 30 | 185 | | |
| 22 | 496 | 100 | 35 | 0.0032 | 10.7 | 3.3 | 0.31 | 315 | 1,830 | 3,250 | 2,540 | 1.22 | 0.80 | 1.01 | 36.8 | 49 | 36 | 30 | 185 | | |
| 23 | 495 | 100 | 49 | 0.0042 | 17.4 | 4.1 | 0.36 | 270 | 2,240 | 4,870 | 3,500 | 1.92 | 1.04 | 1.48 | 36.7 | 50 | 35 | 29 | 186 | | |
| 24 | 526 | 100 | 52 | 0.0042 | 18.1 | 3.5 | 0.35 | 273 | 2,160 | 3,860 | 3,010 | 2.38 | 1.06 | 1.72 | 31.5 | 58 | 43 | 35 | 164 | | |
| 25 | 536 | 100 | 46 | 0.0053 | 10.0 | 1.9 | 0.22 | 405 | 1,480 | 2,640 | 2,060 | 1.14 | 0.72 | 0.93 | 23.1 | 65 | 43 | 37 | 135 | | |
| 26 | 591 | 80 | 36 | 0.0040 | 14.2 | 3.6 | 0.40 | 282 | 2,640 | 5,300 | 3,970 | 1.82 | 1.12 | 1.47 | 35.9 | 71 | 63 | 59 | 107 | | |
| 27 | 592 | 80 | 37 | 0.0042 | 14.7 | 3.5 | 0.40 | 268 | 2,670 | 5,250 | 3,960 | 1.78 | 1.20 | 1.49 | 36.9 | 67 | 60 | 55 | 118 | | |
| 28 | 594 | 80 | 41 | 0.0042 | 17.2 | 4.1 | 0.42 | 231 | 3,040 | 6,620 | 4,330 | 1.86 | 1.12 | 1.46 | 44.6 | 77 | 68 | 59 | 96 | | |
| 29 | 587 | 80 | 38 | 0.0041 | 12.8 | 3.1 | 0.34 | 278 | 2,480 | 4,420 | 3,450 | 2.36 | 1.12 | 1.74 | 36.5 | 70 | 58 | 54 | 118 | | |
| 30 | 593 | 80 | 34 | 0.0042 | 10.2 | 2.4 | 0.30 | 373 | 2,180 | 4,030 | 3,100 | 1.66 | 1.04 | 1.35 | 27.7 | 70 | 62 | 54 | 118 | | |
| 31 | 589 | 80 | 34 | 0.0044 | 10.0 | 2.2 | 0.29 | 420 | 2,080 | 3,680 | 2,880 | 1.52 | 1.18 | 1.35 | 23.6 | 71 | 61 | 53 | 115 | | |
| 32 | 588 | 80 | 34 | 0.0038 | 10.6 | 2.8 | 0.31 | 368 | 2,230 | 4,080 | 3,100 | 2.40 | 1.04 | 1.72 | 27.7 | 70 | 62 | 53 | 115 | | |
| 33 | 590 | 80 | 34 | 0.0048 | 13.8 | 2.9 | 0.34 | 338 | 2,520 | 4,210 | 3,300 | 1.62 | 1.12 | 1.37 | 29.2 | 69 | 58 | 53 | 120 | | |
| 34 | cm. 1.15 | 80 | 34 | 0.0033 | 7.2 | 2.2 | 0.21 | 353 | 1,420 | 2,840 | 2,130 | 1.18 | 0.80 | 0.99 | 26.5 | 62 | 57 | 55 | 126 | | |
| 35 | 649 | 80 | 33 | 0.0041 | 8.2 | 2.0 | 0.25 | 322 | 2,070 | 3,510 | 2,790 | 1.32 | 0.78 | 1.05 | 34.7 | 75 | 66 | 58 | 101 | | |

1 Wood from tree 18 inches in diameter.

2 Wood from tree 42 inches in diameter.

TABLE 36.—Quality tests—Alpine fir.

| Grinder run No. | Paper machine run No. | Ground wood in total furnish. | Weight per ream. | Thickness. | Mullen test. | | | | Schopper tests. | | | | | | Tintometer indications. | | | |
|-----------------|-----------------------|-------------------------------|------------------|------------|--------------|--------------------------|------------|--|------------------|---------|----------|---------|-----------------|---------|-------------------------|--------|--------|--------|
| | | | | | Total. | Per 0.001 in. thickness. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | Stretch. | | Breaking weight | | Red. | Green. | Blue. | Black. |
| | | | | Inch. | Points. | Points. | Points. | | Meters. | Meters. | Per ct. | Per ct. | Grams. | Meters. | Parts. | Parts. | Parts. | Parts. |
| 1 | 580 | 80 | 22 | 0.0026 | 7.1 | 2.7 | 0.32 | 368 | 2,070 | 3,790 | 2.70 | 1.12 | 1.95 | 24.9 | 81 | 73 | 65 | 81 |
| 2 | 581 | 80 | 36 | .0040 | 11.6 | 2.9 | .32 | 290 | 2,090 | 3,700 | 2.94 | 1.48 | 2.21 | 31.2 | 83 | 75 | 66 | 76 |
| 3 | 579 | 80 | 30 | .0035 | 9.0 | 2.5 | .30 | 262 | 1,980 | 1,780 | 2.30 | 1.32 | 1.81 | 23.9 | 83 | 74 | 67 | 76 |
| 4 | 578 | 80 | 35 | .0042 | 9.0 | 2.1 | .26 | 292 | 1,850 | 2,960 | 2.42 | 1.22 | 1.82 | 31.6 | 82 | 74 | 68 | 76 |
| 5 | 582 | 80 | 32 | .0035 | 12.0 | 3.4 | .38 | 262 | 2,240 | 4,180 | 3.12 | 1.38 | 2.25 | 32.2 | 83 | 75 | 67 | 75 |
| 6 | 577 | 78 | 35 | .0038 | 13.0 | 3.4 | .37 | 264 | 2,090 | 4,150 | 3.34 | 1.46 | 2.40 | 32.0 | 83 | 75 | 68 | 74 |
| 7 | 576 | 80 | 37 | .0044 | 12.8 | 2.9 | .35 | 265 | 2,650 | 4,600 | 1.94 | 1.02 | 1.48 | 39.1 | 81 | 74 | 67 | 78 |
| 8 | 575 | 80 | 34 | .0041 | 11.6 | 2.8 | .34 | 252 | 2,840 | 4,850 | 1.80 | 1.06 | 1.43 | 44.8 | 82 | 75 | 68 | 75 |
| 9 | 557 | 100 | 43 | .0039 | 28.2 | 7.3 | .66 | 188 | 3,200 | 6,970 | 3.04 | 1.40 | 2.20 | 41.0 | 54 | 42 | 36 | 168 |
| 10 | 558 | 100 | 37 | .0035 | 22.5 | 6.5 | .61 | 155 | 1,990 | 5,660 | 1.60 | 1.20 | 1.40 | 40.3 | 55 | 42 | 35 | 168 |
| 11 | 559 | 100 | 45 | .0044 | 25.4 | 6.8 | .56 | 159 | 2,080 | 5,200 | 1.68 | 1.04 | 1.36 | 40.9 | 56 | 41 | 35 | 168 |
| 12 | 560 | 100 | 41 | .0038 | 25.2 | 5.7 | .62 | 142 | 2,180 | 6,300 | 1.40 | 1.26 | 1.33 | 48.0 | 53 | 39 | 32 | 176 |
| 13 | 561 | 100 | 33 | .0029 | 9.2 | 3.1 | .28 | 300 | 1,670 | 3,020 | 1.16 | 1.16 | .92 | 27.8 | 68 | 61 | 63 | 108 |
| 13 | 640 | 80 | 35 | .0043 | 12.3 | 2.9 | .35 | 240 | 2,830 | 5,120 | 1.70 | 1.06 | 1.38 | 47.4 | 76 | 70 | 67 | 87 |

1 Commercial.

TABLE 37.—Quality tests—*Amabilis* fr.

| Grinder run No. | Paper machine run No. | Ground wood in total furnish. | Weight per ream. | Thickness. | Mullen test. | | | | Schopper tests. | | | | | | Tintometer indications. | | | | | | |
|-----------------|-----------------------|-------------------------------|------------------|------------|--------------|---------|--------------------------|------------|--|------------------|-------------|----------|------------|-------------|-------------------------|----------------------------------|--------------------------------|------|--------|-------|--------|
| | | | | | Total. | Points. | Per 0.001 in. thickness. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | | Stretch. | | | Breaking weight per sq. mm. sec. | Breaking length per horsepower | Red. | Green. | Blue. | Black. |
| | | | | | | | | | | Crosswise. | Lengthwise. | Average. | Crosswise. | Lengthwise. | Average. | | | | | | |
| 1 | 595 | 80 | 36 | 0.0040 | 16.3 | 4.1 | 0.45 | 205 | 2,560 | 4,900 | 3,730 | 1.92 | 1.06 | 1.49 | 40.3 | 71 | 62 | 58 | 109 | | |
| 2 | 596 | 80 | 36 | 0.0045 | 16.8 | 3.7 | 0.41 | 197 | 2,750 | 4,830 | 3,700 | 2.24 | 1.04 | 1.64 | 47.0 | 71 | 63 | 58 | 108 | | |
| 3 | 621 | 80 | 37 | 0.0042 | 14.0 | 3.4 | 0.38 | 186 | 2,520 | 4,520 | 3,520 | 2.26 | 1.18 | 1.72 | 49.9 | 76 | 66 | 60 | 98 | | |
| 4 | 620 | 80 | 36 | 0.0042 | 12.5 | 3.0 | 0.35 | 189 | 2,510 | 4,240 | 3,380 | 1.82 | 1.14 | 1.48 | 51.0 | 74 | 64 | 59 | 103 | | |
| 5 | 583 | 80 | 31 | 0.0034 | 10.8 | 3.2 | 0.34 | 265 | 1,980 | 3,950 | 2,960 | 2.74 | 1.42 | 2.08 | 32.9 | 72 | 67 | 61 | 105 | | |
| 6 | 585 | 80 | 37 | 0.0039 | 16.8 | 4.4 | 0.45 | 208 | 2,010 | 5,480 | 4,210 | 3.12 | 1.28 | 2.20 | 45.3 | 77 | 67 | 61 | 95 | | |
| 7 | 586 | 80 | 35 | 0.0038 | 14.6 | 3.8 | 0.42 | 217 | 2,540 | 4,840 | 3,690 | 2.26 | 1.24 | 1.75 | 40.5 | 75 | 65 | 59 | 101 | | |
| 8 | 584 | 79 | 31 | 0.0034 | 11.7 | 3.4 | 0.38 | 206 | 2,490 | 4,420 | 3,460 | 1.96 | 1.08 | 1.52 | 44.2 | 77 | 69 | 62 | 92 | | |
| 9 | 682 | 100 | 45 | 0.0038 | 25.0 | 6.6 | 0.56 | 230 | 3,830 | 6,160 | 5,000 | 2.34 | 0.92 | 1.63 | 38.8 | 44 | 32 | 29 | 195 | | |
| 10 | 551 | 100 | 44 | 0.0036 | 28.5 | 8.0 | 0.65 | 152 | 2,900 | 6,120 | 4,510 | 2.62 | 1.14 | 1.88 | 45.5 | 51 | 37 | 32 | 180 | | |
| 11 | 552 | 100 | 37 | 0.0030 | 24.1 | 8.1 | 0.61 | 160 | 3,720 | 5,700 | 4,710 | 3.34 | 0.98 | 2.16 | 45.3 | 47 | 36 | 31 | 186 | | |
| 12 | 549 | 100 | 36 | 0.0030 | 20.6 | 6.8 | 0.57 | 172 | 3,200 | 5,210 | 4,250 | 3.14 | 1.00 | 2.07 | 43.3 | 51 | 38 | 32 | 179 | | |
| 13 | 553 | 100 | 34 | 0.0029 | 19.0 | 6.6 | 0.56 | 198 | 2,820 | 5,520 | 4,220 | 1.71 | 0.98 | 1.36 | 38.0 | 54 | 42 | 36 | 168 | | |
| 14 | 550 | 100 | 40 | 0.0038 | 24.2 | 6.4 | 0.60 | 166 | 3,110 | 5,740 | 4,420 | 3.08 | 1.44 | 2.25 | 44.3 | 65 | 55 | 47 | 133 | | |
| 15 | 117 | 80 | 36 | 0.0033 | 10.2 | 3.1 | 0.28 | 290 | 1,870 | 3,700 | 2,780 | 1.28 | 0.74 | 1.01 | 34.3 | 68 | 61 | 60 | 111 | | |
| 15 | 653 | 80 | 33 | 0.0038 | 13.8 | 3.7 | 0.42 | 193 | 2,770 | 5,130 | 3,950 | 2.74 | 1.38 | 2.06 | 48.7 | 72 | 63 | 59 | 106 | | |

Commercial.

TABLE 38.—Quality tests—lowland fir.

| Grinder run No. | Paper machine run No. | Mullen test. | | | | Schopper tests. | | | | | | Tintometer indications. | | | |
|-----------------|-----------------------|--------------|-------------------------------|------------|--|------------------|--------|-----------|-----------|-------------------------------------|-----------------------------|-------------------------|--------|--------|--------|
| | | Total. | Per 0.001 in. thick- mess. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | Stretch. | | Breaking weight per sq. mm. sec. | Breaking length per ton. | Red. | Green. | Blue. | Black. |
| | | Points | Points | Points | Points | Per cent. | Meters | Per cent. | Per cent. | Grams. | Meters | Parts. | Parts. | Parts. | Parts. |
| 1 | 692 | 25.3 | 6.0 | 0.55 | 154 | 3,850 | 6,700 | 1.74 | 1.08 | 3,510 | 62.4 | 50 | 37 | 32 | 181 |
| 2 | 691 | 25.0 | 5.9 | 0.55 | 145 | 3,800 | 7,340 | 2.10 | 1.14 | 3,540 | 69.6 | 50 | 37 | 31 | 182 |
| 3 | 681 | 22.0 | 6.1 | 0.56 | 147 | 3,300 | 5,790 | 1.84 | 1.02 | 2,920 | 55.3 | 46 | 34 | 30 | 190 |
| 4 | 717 | 13.5 | 3.0 | 0.35 | 199 | 2,880 | 5,530 | 1.58 | 0.96 | 1,271 | 60.4 | 76 | 66 | 62 | 96 |
| 5 | 716 | 10.4 | 2.3 | 0.26 | 216 | 2,340 | 4,580 | 1.48 | 0.80 | 1,470 | 55.3 | 78 | 67 | 61 | 94 |
| 6 | 713 | 14.0 | 2.1 | 0.26 | 226 | 1,960 | 4,080 | 1.28 | 0.88 | 1,360 | 49.2 | 82 | 72 | 65 | 81 |
| 7 | 723 | 12.0 | 2.1 | 0.27 | 220 | 2,550 | 5,160 | 1.60 | 1.12 | 1,511 | 47.4 | 78 | 70 | 63 | 89 |
| 8 | 712 | 10.6 | 2.4 | 0.29 | 251 | 2,300 | 4,440 | 1.66 | 0.92 | 1,620 | 41.7 | 78 | 68 | 63 | 91 |
| 9 | 729 | 12.0 | 3.2 | 0.40 | 202 | 2,770 | 5,020 | 1.44 | 0.96 | 1,201 | 54.5 | 76 | 67 | 61 | 96 |
| 10 | 724 | 13.0 | 2.8 | 0.34 | 243 | 2,750 | 5,120 | 1.50 | 0.92 | 1,201 | 47.6 | 78 | 70 | 62 | 90 |
| 11 | 725 | 15.0 | 3.1 | 0.36 | 208 | 2,780 | 5,120 | 1.80 | 0.88 | 1,341 | 52.8 | 80 | 67 | 61 | 92 |
| 12 | 715 | 13.1 | 3.0 | 0.35 | 260 | 2,480 | 5,180 | 1.64 | 1.02 | 1,331 | 42.2 | 80 | 70 | 63 | 85 |
| 13 | 730 | 17.0 | 4.0 | 0.46 | 170 | 2,950 | 6,130 | 2.04 | 1.14 | 1,591 | 58.0 | 76 | 68 | 61 | 95 |
| 14 | 708 | 13.0 | 2.9 | 0.33 | 213 | 2,610 | 4,900 | 1.52 | 1.04 | 1,221 | 53.5 | 82 | 73 | 67 | 78 |
| 15 | 720 | 13.2 | 3.1 | 0.36 | 251 | 2,630 | 5,140 | 1.78 | 1.04 | 1,411 | 46.7 | 73 | 65 | 60 | 102 |
| 16 | 722 | 14.2 | 3.4 | 0.41 | 205 | 2,600 | 5,450 | 1.76 | 0.94 | 1,391 | 48.0 | 77 | 67 | 62 | 94 |
| 17 | 709 | 12.4 | 3.1 | 0.36 | 230 | 2,800 | 5,200 | 1.76 | 0.94 | 1,301 | 48.4 | 83 | 73 | 68 | 76 |
| 17 | 726 | 12.6 | 3.1 | 0.38 | 211 | 2,700 | 5,640 | 1.58 | 0.92 | 1,251 | 52.3 | 81 | 70 | 62 | 87 |

TABLE 39.—*Quality tests—noble fir.*

| Grinder run No. | Paper machine run No. | Ground wood in total furnish. | Weight per ream. | Thickness. | Mullen test. | | | | Schopper tests. | | | | Tintometer indications. | | | | | | |
|-----------------|-----------------------|-------------------------------|------------------|------------|--------------|---------------------------|------------|--|------------------|-------------|----------|------------|----------------------------------|--------------------------------|------|--------|-------|--------|-------------|
| | | | | | Total. | Per 0.001 in. thick-ness. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | Stretch. | | Breaking weight per sq. mm. sec. | Breaking length per horsepower | Red. | Green. | Blue. | Black. | |
| | | | | | | | | | Crosswise. | Lengthwise. | Average. | Crosswise. | | | | | | | Lengthwise. | Average. |
| 1 | 735 | 80 | 32 | 0.0036 | 18.8 | 5.3 | 0.59 | 190 | 2,690 | 6,490 | 4,590 | 3.04 | 1.54 | 2.29 | 41.0 | 72 | 62 | 58 | 108 |
| 2 | 641 | 80 | 34 | .0035 | 15.5 | 4.5 | .46 | 185 | 3,140 | 5,960 | 4,550 | 1.92 | 1.12 | 1.52 | 53.5 | 73 | 67 | 60 | 100 |
| 3 | 658 | 80 | 35 | .0038 | 15.3 | 4.1 | .44 | 181 | 2,890 | 5,560 | 4,220 | 2.42 | 1.40 | 1.91 | 53.0 | 73 | 64 | 60 | 103 |
| 4 | 639 | 80 | 37 | .0040 | 15.6 | 3.9 | .42 | 165 | 3,090 | 5,440 | 4,260 | 2.20 | 1.14 | 1.67 | 61.3 | 73 | 63 | 53 | 111 |
| 5 | 642 | 80 | 37 | .0037 | 19.0 | 5.2 | .51 | 164 | 3,250 | 6,580 | 4,920 | 2.38 | 1.16 | 1.77 | 59.0 | 72 | 62 | 59 | 107 |
| 6 | 646 | 80 | 33 | .0034 | 17.8 | 5.2 | .54 | 148 | 3,500 | 6,510 | 5,000 | 1.98 | 1.02 | 1.50 | 71.0 | 71 | 62 | 57 | 110 |
| 7 | 736 | 80 | 35 | .0038 | 19.4 | 5.1 | .56 | 155 | 3,120 | 6,530 | 4,820 | 3.10 | 1.46 | 2.28 | 55.5 | 72 | 63 | 57 | 108 |
| 8 | 643 | 80 | 36 | .0038 | 16.9 | 4.4 | .47 | 179 | 3,040 | 5,950 | 4,500 | 2.22 | 1.16 | 1.69 | 53.4 | 72 | 62 | 57 | 109 |
| 9 | 706 | 100 | 40 | .0032 | 22.5 | 6.9 | .55 | 171 | 3,810 | 6,730 | 5,270 | 1.60 | 1.04 | 1.25 | 55.2 | 50 | 35 | 30 | 185 |
| 10 | 701 | 100 | 42 | .0033 | 23.0 | 6.9 | .55 | 166 | 4,020 | 6,020 | 5,020 | 2.18 | 1.04 | 1.61 | 55.0 | 50 | 37 | 31 | 182 |
| 11 | 700 | 100 | 41 | .0033 | 28.4 | 8.7 | .69 | 138 | 4,320 | 7,270 | 5,800 | 2.64 | 1.10 | 1.87 | 60.7 | 50 | 37 | 31 | 182 |
| 12 | 663 | 100 | 32 | .0033 | 16.0 | 4.9 | .49 | 202 | 3,120 | 6,000 | 4,800 | 1.62 | 1.02 | 1.32 | 48.1 | 59 | 49 | 41 | 151 |
| 13 | 654 | 80 | 35 | .0038 | 15.1 | 4.0 | .43 | 179 | 3,100 | 5,870 | 4,480 | 2.70 | 1.40 | 2.05 | 58.2 | 72 | 64 | 58 | 106 |
| 14 | 724 | 80 | 41 | .0042 | 25.9 | 6.0 | .61 | 133 | 3,160 | 7,050 | 5,100 | 3.82 | 1.70 | 2.76 | 62.7 | 71 | 63 | 57 | 109 |
| 15 | 645 | 80 | 32 | .0035 | 13.4 | 3.8 | .42 | 222 | 2,820 | 5,320 | 4,070 | 2.08 | 1.10 | 1.59 | 43.7 | 72 | 64 | 60 | 104 |
| 16 | 113 | 80 | 35 | .0028 | 12.6 | 4.5 | .36 | 256 | 2,260 | 4,630 | 3,440 | 1.60 | .96 | 1.28 | 37.4 | 73 | 56 | 55 | 126 |
| 17 | 647 | 80 | 34 | .0035 | 15.6 | 4.8 | .40 | 188 | 3,370 | 6,240 | 4,400 | 1.98 | 1.04 | 1.50 | 52.2 | 72 | 65 | 60 | 103 |
| 18 | 731 | 80 | 35 | .0042 | 14.8 | 3.5 | .42 | 144 | 2,930 | 5,920 | 4,420 | 1.70 | 1.08 | 1.39 | 72.8 | 71 | 62 | 56 | 111 |
| 19 | 737 | 80 | 33 | .0038 | 17.9 | 4.7 | .54 | 133 | 3,010 | 5,970 | 4,490 | 2.60 | 1.20 | 1.90 | 62.4 | 72 | 62 | 58 | 108 |

1 Commercial.

TABLE 40.—Quality tests—hemlock.

| Grinder run No. | Paper machine run No. | Ground wood in total furnish. | Weight per ream. | Thickness. | Mullen test. | | | Schooper tests. | | | | Tintometer indications. | | | | | | |
|-----------------|-----------------------|-------------------------------|------------------|------------|--------------|--------------------------|------------|--|------------------|-------------|----------|-------------------------|---|---------------------------------|------|--------|-------|--------|
| | | | | | Total. | Per 0.001 in. thickness. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | Stretch. | | Breaking weight per sq. mm. sectional area. | Breaking length per horsepower. | Red. | Green. | Blue. | Black. |
| | | | | | | | | | (Crosswise. | Lengthwise. | Average. | (Crosswise. |  |  |  |  |  |  | Lengthwise. | Average. |
| 53 | 107 | 80 | 32 | 0.0036 | 10.8 | 2.48 | 0.338 | 224 | 2,385 | 3,055 | 1.46 | 0.72 | 1,199 | 40.3 | 71 | 59 | 51 | 119 |
| 54 | 105 | 80 | 33 | 0.0046 | 10.25 | 2.23 | 0.311 | 237 | 2,135 | 3,425 | 1.22 | 0.92 | 1,150 | 37.6 | 75 | 61 | 54 | 110 |
| 55 | 232 | 80 | 35 | 0.0035 | 15.2 | 4.30 | 0.44 | 282 | 2,540 | 3,600 | 2.62 | 1.82 | 1,800 | 29.0 | 69 | 53 | 23 | 203 |
| 56 | 219 | 80 | 30 | 0.0038 | 9.2 | 2.4 | 0.31 | 677 | 2,470 | 4,520 | 1.34 | 1.18 | 1,800 | 16.7 | 66 | 57 | 52 | 125 |
| 60 | 257 | 100 | 54 | 0.0048 | 28.2 | 5.9 | 0.52 | 380 | 3,070 | 5,870 | 2.48 | 1.50 | 2,820 | 22.6 | 42 | 27 | 20 | 211 |
| 61 | 255 | 100 | 54 | 0.0049 | 28.3 | 5.8 | 0.51 | 255 | 3,000 | 5,810 | 3.22 | 1.50 | 2,600 | 33.2 | 41 | 26 | 20 | 214 |
| 62 | 256 | 100 | 55 | 0.0047 | 28.3 | 6.0 | 0.51 | 256 | 2,860 | 5,620 | 3.62 | 1.58 | 2,730 | 32.5 | 41 | 26 | 19 | 213 |

NOTE.—For run No. 63 see Mixture of woods.

TABLE 41.—Quality tests—western hemlock.

| Grinder run No. | Paper machine run No. | Mullen test. | | | | | Schopper tests. | | | | | Tintometer indications. | | | | | | |
|-----------------|-----------------------|--------------|---------|---------|--------------------------|------------|--|------------------|---------|----------|------------|---|---------------------------------|--------|--------|--------|--------|-------------|
| | | Thickness. | | Total. | Per 0.001 in. thickness. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | Stretch. | | Breaking weight sectional area. per sq. mm. | Breaking length per horsepower. | Red. | Green. | Blue. | Black. | |
| | | Inch. | Points. | | | | | Meters. | Per ct. | Average. | Crosswise. | | | | | | | Lengthwise. | Average. |
| | 215 | Per ct. | Pounds. | Points. | Points. | Point. | | Meters. | Meters. | Per ct. | Per ct. | Grams. | Meters. | Parts. | Parts. | Parts. | Parts. | |
| 1 | 215 | 80 | 31 | 0.0037 | 13.4 | 3.6 | 0.42 | 320 | 2,900 | 5,700 | 2.10 | 1.24 | 2,000 | 32.0 | 62 | 53 | 49 | 136 |
| 5 | 372 | 80 | 37 | 0.0040 | 19.6 | 4.9 | 0.53 | 245 | 3,290 | 6,260 | 2.58 | 1.48 | 2,220 | 36.8 | 67 | 55 | 48 | 130 |
| 6 | 373 | 80 | 36 | 0.0041 | 16.5 | 4.0 | 0.46 | 308 | 2,760 | 5,000 | 2.44 | 1.60 | 1,780 | 27.3 | 65 | 55 | 49 | 131 |
| 7 | 403 | 80 | 31 | 0.0033 | 16.6 | 5.0 | 0.54 | 306 | 3,100 | 4,420 | 2.04 | 1.14 | 2,170 | 26.8 | 66 | 55 | 48 | 133 |
| 8 | 402 | 80 | 26 | 0.0030 | 11.3 | 3.8 | 0.44 | 436 | 3,170 | 5,230 | 1.70 | 0.94 | 1,830 | 21.8 | 61 | 51 | 45 | 143 |
| 9 | 321 | 100 | 45 | 0.0036 | 28.0 | 7.8 | 0.62 | 296 | 3,440 | 5,580 | 2.68 | 1.36 | 2,160 | 24.6 | 36 | 22 | 16 | 226 |
| 10 | 352 | 80 | 32 | 0.0035 | 17.0 | 4.9 | 0.52 | 505 | 3,570 | 6,350 | 1.98 | 1.24 | 2,340 | 18.9 | 63 | 50 | 43 | 144 |
| 11 | 341 | 80 | 32 | 0.0043 | 15.9 | 3.6 | 0.50 | 171 | 2,920 | 4,780 | 2.10 | 1.32 | 1,760 | 45.1 | 75 | 61 | 53 | 111 |
| 12 | 342 | 80 | 32 | 0.0040 | 10.9 | 2.7 | 0.34 | 217 | 2,650 | 4,510 | 1.60 | 1.12 | 1,600 | 48.5 | 70 | 57 | 50 | 123 |
| 13 | 353 | 79 | 33 | 0.0043 | 10.1 | 2.4 | 0.30 | 234 | 2,400 | 4,320 | 1.56 | 1.24 | 1,360 | 47.7 | 71 | 58 | 50 | 121 |
| 14 | 354 | 80 | 33 | 0.0045 | 10.4 | 2.3 | 0.31 | 201 | 2,450 | 4,100 | 1.54 | 1.12 | 1,360 | 52.5 | 73 | 60 | 51 | 116 |
| 18 | 12 | 75 | 33 | 0.0028 | 10.1 | 3.6 | 0.31 | 406 | 2,430 | 4,290 | 1.36 | 0.92 | 2,160 | 26.7 | 77 | 63 | 53 | 138 |
| 18 | 445 | 80 | 34 | 0.0039 | 17.8 | 4.6 | 0.52 | 242 | 3,000 | 5,720 | 2.80 | 1.46 | 2,080 | 34.6 | 64 | 52 | 45 | 139 |

NOTE.—For runs 15-17, inclusive, see Mixture of woods.

1 Commercial.

TABLE 42.—Quality tests—tamarack.

| Grinder run No. | Paper machine run No. | Ground wood in total furnish. | Weight per ream. | Thickness. | Mullen test. | | | Schopper tests. | | | | | | Tintometer indications. | | | | |
|-----------------|-----------------------|-------------------------------|------------------|------------|--------------|---------------------------|------------|------------------|-------------|----------|------------|-------------|----------------------------------|--------------------------------|--------|--------|--------|--------|
| | | | | | Total. | Per 0.001 in. thick-ness. | Per pound. | Breaking length. | | | Stretch. | | Breaking weight per sq. mm. sec. | Breaking length per horsepower | Red. | Green. | Blue. | Black. |
| | | | | | | | | Crosswise. | Lengthwise. | Average. | Crosswise. | Lengthwise. |  |  |  |  |  |  | Average. |
| | | | | | Points. | Points. | Points. | Points. | Meters. | Meters. | Meters. | Per ct. | Per ct. | Per ct. | Parts. | Parts. | Parts. | Parts. |
| 1 | 109 | 80 | 32 | 0.0040 | 12.25 | 3.04 | 0.383 | 235 | 2,700 | 4,200 | 3,450 | 2.48 | 1.28 | 1.88 | 83 | 66 | 57 | 94 |
| 2 | 35 | 80 | 32 | 0.0042 | 13.40 | 3.19 | 0.419 | 430 | 2,700 | 4,400 | 3,580 | 1.94 | 1.28 | 1.57 | 69 | 57 | 48 | 126 |
| 3 | 80 | 32 | 32 | 0.0038 | 8.00 | 2.10 | 0.250 | 356 | 1,829 | 4,313 | 3,071 | 1.21 | 1.06 | 1.14 | 73 | 65 | 57 | 105 |
| 4 | 15 | 80 | 33 | 0.0044 | 8.90 | 2.02 | 0.270 | 287 | 2,140 | 3,705 | 2,922 | 1.21 | 0.78 | 1.01 | 79 | 65 | 52 | 104 |
| 5 | 31 | 80 | 32 | 0.0040 | 11.40 | 2.85 | 0.356 | 388 | 2,460 | 4,635 | 3,548 | 1.88 | 0.90 | 1.39 | 68 | 56 | 50 | 126 |
| 6 | 31 | 80 | 32 | 0.0043 | 9.25 | 2.15 | 0.289 | 288 | 1,920 | 3,700 | 2,840 | 1.18 | 0.72 | 0.95 | 73 | 61 | 51 | 115 |
| 7 | 34 | 80 | 32 | 0.0048 | 8.05 | 1.68 | 0.252 | 278 | 1,612 | 3,110 | 2,361 | 0.90 | 0.68 | 0.79 | 74 | 61 | 55 | 110 |
| 8 | 117 | 80 | 33 | 0.00355 | 11.80 | 3.32 | 0.358 | 762 | 2,376 | 4,365 | 3,537 | 2.94 | 1.54 | 2.24 | 70 | 59 | 55 | 116 |
| 9 | 117 | 80 | 33 | 0.00355 | 11.80 | 3.32 | 0.358 | 762 | 2,376 | 4,365 | 3,537 | 2.94 | 1.54 | 2.24 | 70 | 59 | 55 | 116 |
| 10 | 119 | 60 | 35 | 0.00372 | 13.95 | 3.75 | 0.398 | 791 | 2,672 | 4,625 | 3,519 | 2.83 | 1.52 | 1.80 | 65 | 60 | 49 | 126 |
| 11 | 9 | 80 | 33 | 0.0051 | 5.3 | 1.04 | 0.161 | 334 | 1,269 | 2,625 | 1,918 | 1.98 | 0.92 | 1.45 | 77 | 58 | 49 | 88 |
| 12 | 114 | 80 | 33 | 0.00426 | 9.4 | 2.203 | 0.245 | 277 | 1,882 | 2,850 | 2,331 | 1.98 | 1.04 | 1.47 | 80 | 70 | 62 | 88 |
| 13 | 113 | 80 | 34 | 0.00447 | 8.35 | 1.866 | 0.215 | 270 | 1,660 | 2,756 | 2,258 | 1.90 | 0.56 | 1.78 | 77 | 70 | 70 | 66 |
| 14 | 112 | 80 | 30 | 0.00344 | 5.70 | 1.660 | 0.190 | 332 | 1,464 | 2,065 | 1,765 | 1.00 | 0.80 | 1.00 | 65 | 56 | 52 | 127 |
| 15 | 88 | 80 | 35 | 0.00474 | 10.35 | 2.18 | 0.296 | 250 | 2,370 | 3,600 | 2,985 | 1.20 | 0.80 | 1.34 | 77 | 61 | 54 | 108 |
| 16 | 101 | 80 | 35 | 0.00428 | 11.75 | 2.74 | 0.356 | 251 | 2,565 | 4,000 | 3,283 | 1.68 | 0.98 | 1.31 | 75 | 59 | 52 | 114 |
| 17 | 93 | 80 | 35 | 0.0044 | 15.45 | 3.51 | 0.441 | 236 | 2,950 | 4,740 | 3,845 | 1.64 | 1.00 | 1.31 | 67 | 51 | 44 | 138 |
| 18 | 93 | 80 | 35 | 0.0044 | 15.45 | 3.51 | 0.441 | 236 | 2,950 | 4,740 | 3,845 | 1.64 | 1.00 | 1.31 | 67 | 51 | 44 | 138 |
| 19 | 98 | 80 | 33 | 0.00387 | 15.50 | 4.00 | 0.470 | 208 | 3,110 | 4,800 | 3,955 | 1.98 | 1.04 | 1.51 | 72 | 58 | 51 | 119 |
| 20 | 94 | 80 | 31 | 0.00498 | 7.95 | 1.595 | 0.257 | 245 | 2,250 | 3,310 | 2,780 | 1.04 | 0.76 | 0.90 | 81 | 63 | 55 | 101 |
| 21 | 99 | 79 | 33 | 0.00407 | 13.30 | 3.26 | 0.403 | 202 | 2,924 | 4,450 | 3,687 | 1.98 | 1.06 | 1.52 | 66 | 58 | 55 | 108 |
| 22 | 89 | 80 | 33 | 0.00364 | 15.75 | 4.33 | 0.477 | 204 | 3,000 | 4,740 | 3,870 | 1.68 | 1.06 | 1.52 | 67 | 52 | 43 | 138 |
| 23 | 90 | 100 | 30 | 0.00357 | 9.95 | 2.79 | 0.332 | 293 | 3,515 | 5,350 | 3,933 | 1.18 | 0.62 | 0.90 | 33 | 33 | 25 | 190 |
| 24 | 84 | 80 | 34 | 0.00376 | 16.25 | 4.32 | 0.478 | 175 | 2,990 | 4,975 | 3,983 | 2.04 | 1.00 | 1.52 | 51 | 36 | 29 | 184 |
| 25 | 233 | 80 | 35 | 0.0036 | 16.8 | 4.6 | 0.48 | 210 | 2,510 | 5,200 | 2,536 | 0.92 | 1.00 | 1.89 | 83 | 72 | 64 | 81 |
| 26 | 233 | 80 | 35 | 0.0036 | 16.8 | 4.6 | 0.48 | 210 | 2,510 | 5,200 | 2,536 | 0.92 | 1.00 | 1.89 | 83 | 72 | 64 | 81 |
| 27 | 252 | 80 | 32 | 0.0040 | 11.2 | 2.8 | 0.35 | 455 | 2,510 | 4,700 | 3,610 | 2.04 | 1.38 | 1.71 | 43 | 27 | 20 | 210 |
| 28 | 252 | 100 | 44 | 0.0045 | 17.5 | 3.90 | 0.40 | 151 | 2,780 | 4,300 | 3,610 | 1.76 | 1.26 | 1.51 | 46 | 54 | 46 | 136 |
| 29 | 289 | 100 | 51 | 0.0053 | 19.0 | 3.60 | 0.37 | 173 | 3,900 | 5,300 | 3,600 | 1.94 | 1.34 | 1.64 | 44 | 29 | 20 | 207 |
| 30 | 289 | 100 | 45 | 0.0045 | 17.3 | 3.80 | 0.38 | 169 | 2,410 | 4,310 | 3,360 | 2.06 | 1.38 | 1.95 | 47 | 27 | 19 | 211 |
| 31 | 281 | 100 | 43 | 0.0044 | 16.6 | 3.80 | 0.38 | 194 | 2,640 | 4,310 | 3,360 | 1.80 | 1.48 | 1.77 | 43 | 27 | 19 | 213 |
| 32 | 286 | 100 | 46 | 0.0050 | 18.8 | 3.60 | 0.38 | 191 | 2,470 | 4,040 | 3,250 | 1.74 | 1.26 | 1.59 | 44 | 28 | 18 | 209 |
| 33 | 275 | 100 | 46 | 0.0041 | 17.6 | 3.60 | 0.38 | 191 | 2,470 | 4,040 | 3,250 | 1.74 | 1.26 | 1.59 | 44 | 28 | 18 | 209 |
| 34 | 279 | 100 | 53 | 0.0049 | 22.4 | 4.50 | 0.42 | 230 | 2,870 | 4,910 | 3,800 | 2.32 | 1.36 | 1.84 | 40 | 32 | 24 | 220 |
| 35 | 284 | 100 | 39 | 0.0038 | 16.0 | 4.2 | 0.41 | 214 | 2,960 | 4,950 | 3,780 | 1.86 | 1.56 | 1.71 | 39 | 23 | 16 | 222 |
| | | | | | | | | | | | | 1.66 | 1.32 | 1.49 | 42 | 26 | 21 | 222 |
| | | | | | | | | | | | | 1.66 | 1.32 | 1.49 | 42 | 26 | 21 | 222 |
| | | | | | | | | | | | | 1.66 | 1.32 | 1.49 | 42 | 26 | 21 | 222 |

| | | | | | | | | | | | | | | | | | | | | |
|----|-----|-----|-----|-------|------|-----|-----|-----|-------|-------|-------|------|------|------|-------|------|----|----|----|-----|
| 35 | 386 | 100 | 38 | .0038 | 16.7 | 4.4 | .44 | 245 | 2,770 | 5,120 | 3,940 | 1.60 | .94 | 1.27 | 2,220 | 36.6 | 47 | 38 | 24 | 191 |
| 36 | 383 | 100 | 50 | .0051 | 21.0 | 4.1 | .42 | 195 | 2,840 | 4,910 | 3,880 | 1.72 | 1.02 | 1.37 | 2,140 | 47.4 | 49 | 33 | 24 | 194 |
| 37 | 380 | 100 | 44 | .0044 | 22.6 | 5.1 | .51 | 188 | 2,750 | 5,230 | 4,020 | 3.18 | 1.28 | 2.23 | 2,270 | 42.0 | 42 | 27 | 19 | 212 |
| 38 | 364 | 80 | 44 | .0049 | 17.3 | 3.5 | .41 | 298 | 2,730 | 5,040 | 3,880 | 2.22 | 1.46 | 2.23 | 2,270 | 31.8 | 60 | 49 | 40 | 151 |
| 39 | 249 | 100 | 100 | .0048 | 23.2 | 4.8 | .46 | 278 | 2,880 | 2,690 | 2,780 | 2.28 | .88 | 1.54 | 1,670 | 21.8 | 35 | 21 | 15 | 229 |
| 40 | 251 | 100 | 47 | .0044 | 21.5 | 4.8 | .46 | 201 | 2,680 | 5,030 | 3,860 | 2.32 | 1.36 | 1.84 | 2,200 | 41.7 | 36 | 23 | 17 | 224 |
| 41 | 254 | 100 | 53 | .0050 | 25.8 | 5.2 | .49 | 196 | 2,790 | 5,300 | 4,040 | 2.32 | 1.52 | 2.21 | 2,440 | 42.0 | 36 | 23 | 17 | 224 |
| 42 | 250 | 100 | 47 | .0042 | 21.8 | 5.2 | .46 | 290 | 2,850 | 4,490 | 3,670 | 1.90 | 1.12 | 1.51 | 2,220 | 27.5 | 36 | 23 | 17 | 224 |
| 43 | 253 | 100 | 42 | .0038 | 19.3 | 5.0 | .46 | 237 | 2,490 | 4,800 | 3,640 | 1.50 | 1.34 | 1.42 | 2,200 | 33.4 | 39 | 24 | 17 | 220 |
| 44 | 252 | 100 | 44 | .0040 | 20.2 | 5.0 | .46 | 224 | 2,610 | 4,850 | 3,730 | 2.02 | 1.32 | 1.67 | 2,190 | 36.2 | 42 | 26 | 19 | 213 |
| 45 | 272 | 100 | 55 | .0049 | 24.0 | 4.9 | .44 | 236 | 2,590 | 4,990 | 3,790 | 2.22 | 1.40 | 1.81 | 2,270 | 36.6 | 36 | 39 | 21 | 223 |
| 46 | 279 | 100 | 55 | .0049 | 16.7 | 3.4 | .30 | 318 | 2,510 | 4,280 | 3,300 | 1.86 | 1.28 | 1.54 | 2,130 | 34.6 | 39 | 22 | 14 | 225 |
| 47 | 327 | 80 | 43 | .0046 | 17.5 | 3.8 | .40 | 735 | 2,800 | 4,300 | 3,550 | 2.78 | 1.38 | 2.08 | 1,820 | 12.2 | 52 | 41 | 33 | 174 |
| 48 | 320 | 100 | 52 | .0049 | 21.0 | 4.3 | .40 | 108 | 2,680 | 4,040 | 3,360 | 2.34 | 1.34 | 1.84 | 1,990 | 42.3 | 41 | 25 | 18 | 216 |
| 49 | 348 | 80 | 35 | .0037 | 7.8 | 1.7 | .22 | 286 | 1,880 | 3,190 | 2,540 | 1.14 | 1.00 | 1.07 | 970 | 38.0 | 66 | 56 | 46 | 136 |
| 50 | 353 | 100 | 35 | .0033 | 7.4 | 2.2 | .21 | 454 | 1,640 | 2,960 | 2,300 | 1.10 | .72 | .91 | 1,400 | 24.1 | 52 | 46 | 46 | 132 |
| 51 | 353 | 100 | 37 | .0035 | 12.0 | 2.6 | .32 | 288 | 2,250 | 3,950 | 3,100 | 1.54 | .98 | 1.26 | 1,490 | 32.5 | 76 | 63 | 56 | 105 |
| 52 | 454 | 80 | 55 | .0048 | 23.0 | 4.8 | .43 | 255 | 3,210 | 5,480 | 4,340 | 2.20 | 1.24 | 1.72 | 2,910 | 39.6 | 42 | 31 | 27 | 200 |
| 53 | 686 | 100 | 55 | .0047 | 23.9 | 5.6 | .47 | 222 | 3,320 | 5,730 | 4,520 | 1.98 | .98 | 1.48 | 3,260 | 43.2 | 45 | 33 | 27 | 195 |
| 54 | 689 | 100 | 49 | .0043 | 23.1 | 5.3 | .47 | 226 | 3,320 | 5,860 | 4,540 | 2.16 | 1.16 | 1.66 | 3,030 | 42.7 | 44 | 32 | 27 | 197 |
| 55 | 690 | 100 | 60 | .0052 | 25.4 | 4.9 | .42 | 268 | 2,750 | 5,160 | 3,900 | 1.94 | 1.24 | 1.59 | 2,540 | 35.2 | 44 | 32 | 27 | 197 |
| 56 | 683 | 100 | 48 | .0044 | 18.8 | 4.3 | .39 | 308 | 2,840 | 5,170 | 4,000 | 2.00 | 1.38 | 1.69 | 2,560 | 33.3 | 49 | 25 | 30 | 186 |
| 57 | 687 | 100 | 48 | .0044 | 18.8 | 4.3 | .39 | 308 | 2,840 | 5,170 | 4,000 | 2.00 | 1.38 | 1.69 | 2,560 | 33.3 | 49 | 25 | 30 | 186 |
| 58 | 684 | 100 | 50 | .0046 | 20.7 | 4.5 | .41 | 279 | 2,820 | 5,450 | 4,140 | 1.50 | 1.24 | 1.37 | 2,670 | 36.2 | 43 | 32 | 28 | 197 |
| 59 | 685 | 100 | 48 | .0042 | 23.6 | 5.6 | .49 | 269 | 3,520 | 5,060 | 4,290 | 1.68 | .94 | 1.31 | 2,960 | 32.5 | 46 | 33 | 28 | 193 |
| 60 | 684 | 100 | 44 | .0037 | 14.8 | 4.0 | .34 | 239 | 2,330 | 3,900 | 3,120 | 2.20 | 1.08 | 1.04 | 2,160 | 38.4 | 45 | 33 | 28 | 194 |
| 61 | 489 | 100 | 39 | .0036 | 14.8 | 4.1 | .38 | 207 | 2,130 | 3,720 | 2,920 | 2.98 | 1.36 | 2.17 | 1,860 | 37.1 | 45 | 33 | 27 | 196 |
| 62 | 490 | 100 | 36 | .0032 | 12.7 | 3.9 | .35 | 230 | 2,130 | 3,300 | 2,620 | 2.95 | 1.15 | 2.05 | 1,750 | 32.8 | 45 | 33 | 26 | 194 |
| 63 | 491 | 100 | 36 | .0032 | 14.2 | 4.5 | .40 | 221 | 2,400 | 3,980 | 3,190 | 1.52 | .84 | 1.18 | 2,100 | 36.1 | 46 | 34 | 28 | 192 |
| 64 | 492 | 100 | 29 | .0025 | 15.0 | 3.8 | .33 | 286 | 2,210 | 3,290 | 2,750 | .96 | .63 | .80 | 1,780 | 29.1 | 45 | 34 | 28 | 193 |
| 65 | 493 | 100 | 37 | .0033 | 15.0 | 4.6 | .40 | 257 | 2,420 | 4,560 | 3,490 | 1.73 | 1.10 | 1.42 | 2,200 | 34.0 | 42 | 30 | 25 | 203 |
| 66 | 494 | 100 | 38 | .0032 | 17.4 | 5.4 | .45 | 220 | 2,400 | 4,420 | 3,410 | 1.78 | 1.14 | 1.46 | 2,480 | 34.4 | 44 | 32 | 26 | 198 |
| 67 | 528 | 100 | 44 | .0042 | 12.8 | 3.1 | .29 | 230 | 1,870 | 3,700 | 2,780 | 2.16 | 1.02 | 1.59 | 1,730 | 41.7 | 36 | 25 | 20 | 219 |
| 68 | 529 | 100 | 44 | .0043 | 12.4 | 2.9 | .28 | 252 | 1,500 | 3,100 | 2,300 | 2.46 | 1.02 | 1.74 | 1,330 | 32.5 | 39 | 23 | 23 | 211 |
| 69 | 530 | 100 | 43 | .0038 | 12.2 | 3.2 | .28 | 260 | 1,740 | 3,610 | 2,675 | 2.98 | 1.46 | 2.22 | 1,730 | 36.8 | 40 | 27 | 23 | 210 |
| 70 | 531 | 100 | 51 | .0046 | 19.2 | 4.2 | .38 | 202 | 1,960 | 4,180 | 3,070 | 3.48 | 1.34 | 2.41 | 1,930 | 40.0 | 42 | 30 | 25 | 203 |
| 71 | 532 | 100 | 52 | .0047 | 21.1 | 4.5 | .41 | 180 | 2,180 | 4,550 | 3,360 | 4.32 | 1.66 | 2.99 | 2,110 | 45.5 | 46 | 35 | 30 | 189 |
| 72 | 533 | 100 | 50 | .0049 | 16.6 | 3.4 | .33 | 225 | 1,890 | 3,570 | 2,730 | 3.32 | 1.44 | 2.38 | 1,550 | 36.8 | 49 | 37 | 29 | 185 |
| 73 | 533 | 100 | 53 | .0055 | 17.6 | 3.2 | .33 | 212 | 1,970 | 3,490 | 2,720 | 3.20 | 1.40 | 2.30 | 1,560 | 38.8 | 54 | 42 | 36 | 168 |
| 74 | 534 | 100 | 50 | .0052 | 13.3 | 2.6 | .27 | 244 | 1,640 | 3,230 | 2,540 | 2.52 | 1.34 | 1.93 | 1,310 | 38.4 | 39 | 47 | 41 | 153 |
| 75 | 535 | 100 | 64 | .0078 | 12.6 | 3.6 | .20 | 289 | 1,600 | 1,730 | 1,700 | 1.76 | 1.38 | 1.82 | 840 | 29.4 | 67 | 56 | 51 | 126 |
| 76 | 721 | 80 | 40 | .0044 | 16.6 | 3.8 | .42 | 389 | 2,620 | 5,950 | 4,340 | 1.94 | .98 | 1.46 | 2,030 | 26.5 | 66 | 56 | 50 | 128 |
| 77 | 723 | 80 | 40 | .0045 | 11.2 | 2.5 | .29 | 639 | 2,620 | 4,320 | 3,470 | 1.98 | 1.20 | 1.59 | 1,500 | 18.2 | 62 | 52 | 46 | 140 |
| 78 | 721 | 80 | 39 | .0040 | 18.2 | 4.6 | .46 | 822 | 3,060 | 6,040 | 4,560 | 2.14 | 1.14 | 1.64 | 2,470 | 12.3 | 62 | 52 | 46 | 140 |
| 79 | 655 | 80 | 40 | .0040 | 18.2 | 4.6 | .46 | 822 | 3,060 | 6,040 | 4,560 | 2.14 | 1.14 | 1.64 | 2,470 | 12.3 | 62 | 52 | 46 | 140 |
| 80 | 719 | 80 | 41 | .0043 | 17.0 | 4.0 | .42 | 888 | 2,990 | 5,500 | 4,200 | 1.78 | .98 | 1.38 | 2,510 | 11.3 | 61 | 50 | 43 | 146 |

1 Commercial.

NOTE.—For runs 50 to 52, inclusive, and run 54 see quality tests—mixtures of woods.

TABLE 43.—*Quality tests—western larch.*

| Grinder run No. | Paper machine run No. | Ground wood in total furnish. | Weight per ream. | Thickness. | Mullen test. | | | | Schopper tests. | | | | | | Tintometer indications. | | | | | |
|-----------------|-----------------------|-------------------------------|------------------|------------|--------------|--------------------------|------------|--|------------------|-------------|----------|------------|-------------|----------|---|---|--------|--------|--------|--------|
| | | | | | Total. | Per 0.001 in. thickness. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | | Stretch. | | | Breaking weight per sq. mm. sectional area. | Breaking length per horsepower per ton. | Red. | Green. | Blue. | Black. |
| | | | | | | | | | Crosswise. | Lengthwise. | Average. | Crosswise. | Lengthwise. | Average. | | | | | | |
| | | Per ct. | Lbs. | Inch. | Points. | Points. | Point. | | Meters. | Meters. | Per ct. | Per ct. | Per ct. | Grams. | Meters. | Parts. | Parts. | Parts. | Parts. | |
| 1 | 108 | 80 | 33 | 0.00375 | 14.9 | 3.97 | 0.451 | 260 | 2,380 | 4,620 | 2.26 | 1.28 | 1.77 | 1,750 | 29.8 | 53 | 38 | 29 | 180 | |
| 2 | 221 | 80 | 34 | .0038 | 6.6 | 1.4 | .20 | 518 | 1,500 | 2,910 | 1.14 | .98 | 1.06 | 869 | 21.7 | 56 | 42 | 36 | 166 | |
| 5 | 328 | 80 | 39 | .0047 | 10.0 | 2.2 | .26 | 716 | 1,980 | 3,360 | 1.94 | 1.30 | 1.62 | 1,250 | 14.4 | 81 | 47 | 36 | 136 | |
| 6 | 344 | 80 | 36 | .0042 | 11.3 | 2.7 | .31 | 900 | 2,380 | 4,310 | 1.56 | 1.25 | 1.41 | 1,520 | 12.0 | 59 | 45 | 35 | 161 | |
| 7 | 739 | 80 | 33 | .0045 | 4.4 | .9 | .13 | 665 | 1,160 | 2,030 | 1.78 | .58 | .68 | 570 | 18.5 | 62 | 48 | 42 | 148 | |
| 8 | 456 | 80 | 39 | .0055 | 9.5 | 1.7 | .24 | 500 | 1,770 | 3,050 | 1.40 | .90 | 1.15 | 1,030 | 20.0 | 66 | 53 | 46 | 135 | |
| 9 | 457 | 80 | 42 | .0056 | 9.6 | 1.7 | .28 | 420 | 1,750 | 2,720 | 1.62 | 1.02 | 1.32 | 1,000 | 23.2 | 63 | 52 | 45 | 140 | |
| 10 | 458 | 80 | 40 | .0056 | 7.0 | 1.3 | .18 | 480 | 1,500 | 2,400 | 1.42 | .92 | 1.17 | 830 | 22.8 | 61 | 53 | 47 | 136 | |

TABLE 44.—Quality tests—Montana lodgepole pine.

| Grinder run No. | Paper machine run No. | Ground wood in total furnish. | Weight per ream. | Thickness. | Mullen test. | | | | Schopper tests. | | | | | | Tintometer indications. | | | |
|-----------------|-----------------------|-------------------------------|------------------|------------|--------------|--------------------------|------------|--|------------------|------------|-------------|----------|---------|---------|----------------------------------|--------------------------|------|--------|
| | | | | | Total. | Per 0.001 in. thickness. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | | Stretch. | | | Breaking weight per sq. mm. sec. | Breaking length per ton. | Red. | Green. |
| | | | | | Points. | Points. | Points. | Points. | Meters. | Crosswise. | Lengthwise. | Average. | Per ct. | Per ct. | | | | |
| 1 | 70 | 80 | 32 | 0.0038 | 16.15 | 4.25 | 0.505 | 247 | 3,430 | 5,780 | 4,605 | 1.12 | 1.58 | 1.63 | 2,140 | 37.0 | 84 | 70 |
| 2 | 38 | 80 | 33 | 0.0045 | 14.20 | 3.16 | 0.430 | 245 | 2,335 | 4,830 | 3,578 | 1.18 | 1.63 | 1.63 | 1,145 | 33.9 | 86 | 72 |
| 3 | 30 | 80 | 32 | 0.0044 | 8.90 | 2.02 | 0.278 | 250 | 2,035 | 4,100 | 3,063 | 1.16 | 1.84 | 1.00 | 1,210 | 44.1 | 86 | 71 |
| 4 | 2 | 80 | 31 | 0.0039 | 7.30 | 1.87 | 0.235 | 272 | 2,048 | 4,452 | 2,985 | 1.34 | 1.86 | 1.10 | 1,139 | 46.6 | 88 | 76 |
| 5 | 36 | 80 | 34 | 0.0039 | 13.25 | 3.40 | 0.390 | 277 | 2,465 | 5,110 | 3,788 | 2.14 | 1.65 | 1.05 | 1,810 | 35.1 | 81 | 70 |
| 6 | 46 | 80 | 33 | 0.0039 | 11.90 | 3.05 | 0.361 | 268 | 2,360 | 4,410 | 3,100 | 2.46 | 1.24 | 1.85 | 1,490 | 35.1 | 88 | 71 |
| 7 | 37 | 80 | 30 | 0.0037 | 18.90 | 2.40 | 0.296 | 298 | 1,923 | 4,035 | 2,979 | 2.02 | 1.10 | 1.56 | 1,238 | 33.7 | 85 | 73 |
| 8 | 7 | 80 | 34 | 0.0033 | 17.35 | 5.26 | 0.510 | 203 | 2,170 | 5,138 | 3,664 | 1.55 | 0.98 | 1.27 | 1,705 | 36.4 | 55 | 35 |
| 9 | 222 | 80 | 30 | 0.0040 | 11.6 | 2.9 | 0.38 | 299 | 2,630 | 4,980 | 3,800 | 2.16 | 1.35 | 1.76 | 1,600 | 33.4 | 80 | 69 |
| 13 | 283 | 100 | 42 | 0.0034 | 23.3 | 7.0 | 0.55 | 257 | 3,520 | 6,950 | 5,240 | 1.80 | 1.36 | 1.58 | 3,730 | 37.1 | 39 | 22 |
| 14 | 378 | 100 | 46 | 0.0038 | 30.5 | 8.0 | 0.66 | 194 | 2,820 | 5,720 | 4,270 | 4.62 | 1.52 | 1.63 | 2,930 | 33.4 | 46 | 26 |
| 15 | 15 | 80 | 47 | 0.0038 | 25.2 | 6.6 | 0.54 | 246 | 3,110 | 5,740 | 4,440 | 1.96 | 1.30 | 1.07 | 3,040 | 33.6 | 40 | 26 |
| 16 | 330 | 80 | 35 | 0.0047 | 13.6 | 3.0 | 0.39 | 247 | 2,600 | 4,300 | 3,450 | 2.12 | 1.18 | 1.65 | 1,480 | 35.9 | 81 | 70 |
| 17 | 331 | 80 | 36 | 0.0047 | 14.2 | 3.0 | 0.39 | 262 | 3,000 | 4,580 | 3,790 | 2.02 | 1.22 | 1.67 | 1,890 | 37.1 | 82 | 71 |
| 18 | 346 | 80 | 49 | 0.0045 | 17.1 | 3.8 | 0.35 | 316 | 3,120 | 5,470 | 4,300 | 2.10 | 1.28 | 1.69 | 1,890 | 35.3 | 81 | 68 |
| 19 | 345 | 80 | 36 | 0.0044 | 14.4 | 3.3 | 0.40 | 265 | 3,170 | 4,720 | 3,740 | 2.10 | 1.28 | 1.69 | 1,890 | 35.3 | 82 | 67 |
| 20 | 429 | 80 | 30 | 0.0036 | 12.2 | 3.4 | 0.44 | 323 | 2,880 | 5,120 | 4,000 | 1.72 | 0.94 | 1.33 | 1,790 | 31.0 | 73 | 64 |
| 21 | 430 | 80 | 30 | 0.0035 | 13.2 | 3.8 | 0.44 | 308 | 2,930 | 5,840 | 4,380 | 1.84 | 1.00 | 1.42 | 2,010 | 32.3 | 77 | 68 |
| 22 | 431 | 80 | 37 | 0.0042 | 17.4 | 4.1 | 0.44 | 231 | 2,980 | 5,420 | 4,200 | 2.10 | 1.02 | 1.56 | 1,980 | 41.3 | 79 | 70 |
| 23 | 432 | 80 | 31 | 0.0040 | 12.0 | 3.0 | 0.39 | 243 | 2,640 | 4,530 | 3,580 | 1.88 | 0.90 | 1.39 | 1,550 | 37.8 | 80 | 67 |
| 26 | 1 | 75 | 33 | 0.0028 | 8.9 | 3.2 | 0.27 | 510 | 1,870 | 3,980 | 2,920 | 1.20 | 0.76 | 0.98 | 1,980 | 21.2 | 60 | 54 |
| 26 | 447 | 80 | 33 | 0.0038 | 13.8 | 3.6 | 0.42 | 328 | 2,840 | 4,940 | 3,890 | 2.34 | 1.48 | 1.91 | 1,820 | 28.2 | 71 | 57 |

1 Commercial.

NOTE.—For runs 24 and 25, see Mixture of woods.

TABLE 45.—*Quality tests—lodgepole pine (California).*

| Grinder run No. | Paper machine run No. | Ground wood in total furnish. | Weight per ream. | Thickness. | Mullen test. | | | | Schopper tests. | | | | | | Tintometer indications. | | | | | |
|-----------------|-----------------------|-------------------------------|------------------|------------|--------------|--------------------------|------------|--|------------------|-------------|----------|------------|-------------|----------|----------------------------------|--------------------------------|------|--------|-------|--------|
| | | | | | Total. | Per 0.001 in. thickness. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | | Stretch. | | | Breaking weight per sq. mm. sec. | Breaking length per horsepower | Red. | Green. | Blue. | Black. |
| | | | | | | | | | Crosswise. | Lengthwise. | Average. | Crosswise. | Lengthwise. | Average. | | | | | | |
| 1 | 236 | 80 | 33 | .0031 | 18.4 | 6.0 | 0.56 | 222 | 2,530 | 5,620 | 4,080 | 1.78 | 1.38 | 1.58 | 2,120 | 32.8 | 45 | 28 | 206 | |
| 2 | 213 | 80 | 32 | .0041 | 12.2 | 3.0 | .38 | 362 | 2,760 | 5,180 | 3,970 | 1.46 | 1.30 | 1.18 | 1,630 | 28.9 | 72 | 62 | 110 | |
| 10 | 360 | 80 | 34 | .0042 | 15.0 | 3.6 | .44 | 527 | 2,950 | 6,100 | 4,520 | 1.96 | 1.63 | 1.63 | 1,920 | 19.5 | 78 | 69 | 92 | |
| 11 | 361 | 80 | 35 | .0040 | 17.6 | 4.4 | .50 | 428 | 2,850 | 5,550 | 4,200 | 3.32 | 1.82 | 2.57 | 1,910 | 19.6 | 76 | 67 | 98 | |
| 12 | 362 | 80 | 36 | .0043 | 15.3 | 3.6 | .42 | 593 | 2,490 | 5,140 | 3,820 | 2.36 | 1.60 | 1.98 | 1,690 | 15.3 | 77 | 65 | 57 | |
| 13 | 371 | 80 | 36 | .0043 | 14.2 | 3.3 | .39 | 534 | 2,240 | 4,620 | 3,430 | 2.38 | 1.60 | 1.99 | 1,500 | 16.5 | 62 | 52 | 140 | |
| 14 | 363 | 80 | 38 | .0044 | 17.2 | 3.9 | .45 | 555 | 2,700 | 5,180 | 3,940 | 2.84 | 1.52 | 2.18 | 1,700 | 15.8 | 83 | 73 | 80 | |
| 15 | 323 | 80 | 32 | .0030 | 11.3 | 3.7 | .36 | 448 | 2,030 | 3,550 | 2,790 | 1.58 | 1.10 | 1.34 | 1,680 | 17.3 | 80 | 67 | 93 | |
| 16 | 369 | 82 | 35 | .0044 | 12.8 | 2.9 | .37 | 362 | 2,580 | 4,710 | 3,640 | 2.28 | 1.48 | 1.88 | 1,540 | 17.2 | 78 | 68 | 96 | |
| 17 | 387 | 84 | 31 | .0038 | 11.8 | 3.1 | .38 | 309 | 2,800 | 4,370 | 3,580 | 1.56 | 1.78 | 1.17 | 1,520 | 30.5 | 84 | 74 | 59 | |
| 18 | 376 | 80 | 34 | .0044 | 12.0 | 2.7 | .35 | 332 | 2,200 | 4,220 | 3,210 | 2.00 | 1.58 | 1.79 | 1,280 | 27.7 | 80 | 70 | 90 | |
| 19 | 433 | 80 | 34 | .0039 | 16.1 | 4.1 | .47 | 509 | 2,840 | 5,740 | 4,290 | 1.92 | 1.06 | 1.49 | 2,030 | 17.9 | 80 | 70 | 60 | |
| 20 | 434 | 80 | 32 | .0038 | 13.6 | 3.6 | .42 | 468 | 2,840 | 5,510 | 4,180 | 2.02 | .96 | 1.49 | 1,920 | 21.3 | 74 | 60 | 55 | |
| 21 | 435 | 80 | 31 | .0038 | 12.4 | 3.3 | .40 | 349 | 2,800 | 5,400 | 4,100 | 1.46 | 1.06 | 1.19 | 1,790 | 29.4 | 70 | 62 | 57 | |
| 26 | cml. 7 | 75 | 34 | .0034 | 7.4 | 2.2 | .22 | 352 | 1,450 | 2,740 | 2,100 | 1.32 | .80 | 1.06 | 1,320 | 27.1 | 62 | 57 | 124 | |
| 26 | 450 | 80 | 34 | .0050 | 9.6 | 1.9 | .28 | 277 | 2,230 | 3,750 | 2,990 | 1.68 | .94 | 1.31 | 1,120 | 38.6 | 75 | 62 | 108 | |

NOTE.—For runs 22 to 25, inclusive, see Mixture of woods.

TABLE 46.—Quality tests—western yellow pine.

| Grinder run No. | Paper machine run No. | Ground wood in total furnish. | Weight per ream. | Mullen test. | | | | Schopper tests. | | | | | | Tintometer indications. | | | | | | |
|-----------------|-----------------------|-------------------------------|------------------|--------------|------------------------------|------------|--|------------------|-------|----------|---------|---|---|-------------------------|--------|-------|--------|---------|---------|-----------|
| | | | | Total. | Per 0.001 inch of thickness. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | Stretch. | | Breaking weight per square millimeter sectional area. | Breaking length per horsepower per ton. | Red. | Green. | Blue. | Black. | | | |
| | | | | | | | | Thickness. | Inch. | Points. | Points. | | | | | | | Meters. | Meters. | Per cent. |
| 1 | 102 | 79 | 35 | 0.00316 | 11.4 | 3.61 | 0.326 | 282 | 2,296 | 3,456 | 2,876 | 1.36 | 0.68 | 1.02 | 1,878 | 31.3 | 79 | 57 | 49 | 115 |
| 2 | 106 | 80 | 34 | .0034 | 11.9 | 2.34 | .350 | 218 | 2,240 | 3,770 | 3,005 | 1.16 | .90 | 1.03 | 1,250 | 39.4 | 84 | 70 | 62 | 84 |
| 3 | 105 | 80 | 34 | .0043 | 11.15 | 2.59 | .328 | 226 | 1,778 | 4,583 | 3,181 | 1.01 | 1.05 | 1.03 | 1,375 | 43 | 81 | 61 | 53 | 105 |
| 4 | 223 | 80 | 35 | .0049 | 11.3 | 2.3 | .32 | 324 | 2,340 | 4,400 | 3,370 | 1.86 | 1.28 | 1.57 | 1,340 | 32.5 | 79 | 67 | 59 | 95 |
| 8 | 300 | 100 | 47 | .0044 | 28.6 | 6.5 | .61 | 247 | 3,560 | 6,000 | 4,780 | 2.46 | 1.58 | 2.02 | 2,990 | 31.8 | 51 | 34 | 25 | 190 |
| 9 | 271 | 100 | 33 | .0031 | 16.2 | 5.23 | .49 | 225 | 2,870 | 5,300 | 4,080 | 1.76 | 1.30 | 1.53 | 2,350 | 36.9 | 50 | 34 | 24 | 192 |
| 10 | 273 | 100 | 46 | .0042 | 25.0 | 5.0 | .54 | 223 | 3,090 | 5,620 | 4,300 | 1.86 | 1.36 | 2.11 | 2,680 | 36.3 | 48 | 30 | 22 | 200 |
| 11 | 319 | 100 | 35 | .0037 | 15.4 | 4.2 | .44 | 719 | 2,970 | 5,540 | 4,260 | 1.84 | 1.40 | 1.62 | 2,260 | 13.5 | 72 | 59 | 49 | 120 |
| 12 | 347 | 80 | 36 | .0038 | 12.5 | 3.3 | .35 | 293 | 2,660 | 5,080 | 3,870 | 1.94 | 1.22 | 1.58 | 1,630 | 38 | 80 | 68 | 59 | 93 |
| 13 | 351 | 80 | 34 | .0044 | 13.5 | 3.1 | .40 | 346 | 2,950 | 4,830 | 3,780 | 1.78 | 1.18 | 1.48 | 1,560 | 28 | 81 | 69 | 58 | 92 |
| 14 | 349 | 80 | 34 | .0045 | 11.4 | 2.5 | .33 | 424 | 2,500 | 4,460 | 3,480 | 1.92 | 1.18 | 1.55 | 1,350 | 24.8 | 81 | 68 | 57 | 94 |
| 15 | 350 | 80 | 34 | .0046 | 12.5 | 2.7 | .37 | 364 | 2,690 | 4,900 | 3,400 | 1.76 | 1.12 | 1.44 | 1,460 | 20.8 | 81 | 67 | 55 | 97 |
| 16 | 408 | 80 | 37 | .0048 | 14.6 | 3.0 | .40 | 286 | 2,890 | 5,380 | 4,140 | 1.60 | .88 | 1.24 | 1,820 | 36.2 | 76 | 64 | 55 | 105 |
| 17 | 422 | 80 | 37 | .0046 | 11.2 | 2.4 | .30 | 271 | 2,420 | 4,060 | 3,240 | 1.56 | 1.00 | 1.30 | 1,400 | 39.9 | 76 | 64 | 55 | 105 |
| 18 | 409 | 80 | 32 | .0046 | 8.0 | 1.7 | .25 | 263 | 2,180 | 3,330 | 2,700 | 1.00 | .66 | 1.00 | 1,060 | 41.9 | 77 | 65 | 56 | 102 |
| 19 | 423 | 80 | 41 | .0055 | 11.2 | 2.0 | .27 | 233 | 2,070 | 3,680 | 2,880 | 1.40 | .98 | 1.19 | 1,200 | 45.8 | 77 | 63 | 54 | 106 |
| 27 | 423 | 75 | 32 | .0033 | 5.4 | 1.6 | .17 | 379 | 1,150 | 2,710 | 1,930 | .78 | .74 | 1.76 | 1,040 | 29.9 | 61 | 56 | 56 | 127 |
| 27 | 448 | 80 | 36 | .0048 | 9.4 | 2.0 | .26 | 248 | 2,050 | 3,500 | 2,780 | 1.92 | .92 | 1.42 | 1,150 | 43.1 | 74 | 62 | 51 | 113 |

1 Commercial.

NOTE.—For runs 20 to 26, inclusive, see Mixture of woods.

TABLE 47.—*Quality tests—jack pine.*

| Grinder run No. | Paper machine run No. | Ground wood in total furnish. | Weight per ream. | Thickness. | Mullen test. | | | | Schopper tests. | | | | Tintometer indications. | | | | | |
|-----------------|-----------------------|-------------------------------|------------------|------------|--------------|--------------------------|------------|--|------------------|---------|----------|---------|----------------------------------|--------------------------------|--------|--------|--------|--------|
| | | | | | Total. | Per 0.001 in. thickness. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | Stretch. | | Breaking weight per sq. mm. sec. | Breaking length per horsepower | Red. | Green. | Blue. | Black. |
| | | | Pounds. | Inch. | Points. | Points. | Points. | | Meters. | Meters. | Per ct. | Per ct. | Grams. | Meters. | Parts. | Parts. | Parts. | Parts. |
| 25 | 120 | 80 | 31 | 0.00445 | 8.4 | 1.89 | 0.271 | 267 | 2,272 | 3,000 | 1.28 | 0.74 | 1.01 | 963 | 87 | 72 | 65 | 76 |
| 26 | 231 | 80 | 34 | 0.0036 | 14.6 | 4.0 | .43 | 258 | 2,180 | 4,530 | 1.92 | 1.30 | 1.61 | 1,630 | 50 | 34 | 26 | 190 |
| 27 | 214 | 80 | 34 | 0.0047 | 11.8 | 2.5 | .35 | 427 | 2,340 | 4,710 | 2.24 | 1.12 | 1.68 | 1,420 | 76 | 64 | 57 | 103 |
| 28 | 276 | 100 | 45 | 0.0042 | 22.5 | 5.3 | .50 | 296 | 3,140 | 4,860 | 2.28 | 1.26 | 1.77 | 2,340 | 98 | 38 | 22 | 200 |
| 29 | 287 | 100 | 49 | 0.0048 | 22.8 | 4.8 | .46 | 265 | 2,900 | 5,480 | 2.08 | 1.56 | 1.82 | 2,440 | 51 | 33 | 24 | 192 |
| 30 | 287 | 100 | 43 | 0.0044 | 20.3 | 4.6 | .47 | 250 | 2,680 | 5,030 | 2.06 | 1.66 | 1.81 | 2,200 | 48 | 30 | 23 | 199 |
| 31 | 269 | 100 | 40 | 0.0038 | 18.2 | 4.9 | .46 | 264 | 2,770 | 4,940 | 2.16 | 1.28 | 1.72 | 2,180 | 46 | 28 | 20 | 206 |
| 32 | 301 | 100 | 47 | 0.0050 | 21.0 | 4.2 | .45 | 515 | 3,280 | 5,390 | 2.40 | 1.36 | 1.88 | 2,360 | 65 | 50 | 38 | 147 |
| 33 | 298 | 100 | 37 | 0.0042 | 13.0 | 3.1 | .35 | 251 | 2,180 | 3,580 | 1.70 | 1.48 | 1.59 | 1,440 | 48 | 31 | 24 | 197 |

TABLE 48.—Quality tests—loblolly pine.
FALL-CUT WOOD.

| Grinder run No. | Paper machine run No. | Mullen test. | | | | Schopper tests. | | | | Tintometer indications. | | | | | | | |
|-----------------|-----------------------|--------------|-------------------------------|------------|--|------------------|-------------|----------|------------|-------------------------------------|-----------------------------------|--------|---------|--------|--------|-------------|----------|
| | | Total. | Per 0.001 in. thick- ness. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | Stretch. | | Breaking weight per sq. mm. sec. | Breaking length per horsepower | Red. | Green. | Blue. | Black. | | |
| | | | | | | Crosswise. | Lengthwise. | Average. | Crosswise. | | | | | | | Lengthwise. | Average. |
| | | Points. | Points. | Point. | | Meters. | Meters. | Meters. | Per ct. | Per ct. | Per ct. | Grams. | Meters. | Parts. | Parts. | Parts. | Parts. |
| 1 | 611 | 11.0 | 2.2 | 0.28 | 330 | 2,150 | 3,840 | 3,000 | 1.62 | 0.90 | 1.26 | 1,420 | 32.4 | 81 | 70 | 61 | 88 |
| 2 | 610 | 11.1 | 2.1 | 0.26 | 314 | 2,180 | 3,315 | 2,750 | 1.58 | 0.86 | 1.17 | 1,330 | 33.7 | 80 | 71 | 62 | 88 |
| 3 | 612 | 15.2 | 3.0 | 0.35 | 329 | 2,320 | 4,720 | 3,520 | 1.92 | 1.24 | 1.84 | 1,840 | 30.6 | 73 | 63 | 65 | 99 |
| 4 | 616 | 16.0 | 3.0 | 0.36 | 360 | 2,550 | 4,040 | 3,300 | 1.94 | 1.08 | 1.51 | 1,660 | 25.5 | 82 | 73 | 64 | 81 |
| 5 | 614 | 16.2 | 3.4 | 0.41 | 474 | 2,620 | 5,310 | 3,960 | 1.92 | 1.06 | 1.49 | 2,020 | 20.4 | 84 | 72 | 65 | 79 |
| 6 | 603 | 14.3 | 2.8 | 0.34 | 276 | 2,525 | 3,950 | 3,240 | 1.78 | 0.96 | 1.37 | 1,610 | 34.5 | 75 | 65 | 58 | 102 |
| 7 | 742 | 10.6 | 2.2 | 0.26 | 362 | 2,100 | 4,130 | 3,200 | 1.42 | 0.94 | 1.18 | 1,390 | 33.1 | 76 | 70 | 62 | 92 |
| 8 | 604 | 10.8 | 2.5 | 0.29 | 325 | 2,320 | 4,090 | 3,200 | 1.46 | 0.96 | 1.21 | 1,590 | 32.8 | 74 | 65 | 59 | 203 |
| 9 | 598 | 20.4 | 4.7 | 0.42 | 278 | 2,780 | 4,890 | 3,800 | 1.64 | 1.06 | 1.45 | 2,570 | 28.0 | 80 | 71 | 62 | 85 |
| 10 | 634 | 10.3 | 2.4 | 0.28 | 396 | 2,170 | 4,040 | 2,620 | 1.54 | 0.86 | 1.20 | 1,470 | 32.7 | 80 | 70 | 62 | 87 |
| 11 | 632 | 7.3 | 1.7 | 0.22 | 415 | 1,770 | 3,470 | 2,780 | 1.48 | 0.92 | 1.20 | 1,240 | 32.6 | 80 | 71 | 62 | 87 |
| 12 | 631 | 9.9 | 2.0 | 0.25 | 328 | 1,940 | 3,620 | 2,880 | 1.22 | 0.94 | 1.08 | 1,340 | 32.6 | 74 | 68 | 60 | 98 |
| 13 | 605 | 9.2 | 1.8 | 0.25 | 353 | 1,930 | 3,830 | 2,880 | 1.22 | 0.94 | 1.08 | 1,340 | 32.6 | 74 | 68 | 60 | 98 |
| 14 | 636 | 8.2 | 1.6 | 0.22 | 325 | 1,910 | 3,320 | 2,620 | 1.28 | 0.82 | 1.05 | 1,000 | 36.6 | 78 | 69 | 61 | 92 |

| SPRING-CUT WOOD. | | | | | | | | | | | | | | | | | | |
|------------------|-----|--------|------|--------|------|-----|-------|-------|-------|-------|------|------|-------|------|----|----|----|-----|
| | | | | | | | | | | | | | | | | | | |
| 3 | 609 | 0.0045 | 14.1 | 3.1 | 0.35 | 386 | 2,590 | 4,920 | 3,760 | 1.68 | 1.12 | 1.40 | 1,990 | 27.2 | 71 | 61 | 55 | 113 |
| 4 | 608 | 0.0047 | 11.0 | 2.3 | 0.29 | 425 | 2,270 | 4,300 | 3,285 | 1.54 | 0.90 | 1.22 | 1,585 | 26.6 | 70 | 60 | 54 | 116 |
| 5 | 613 | 80 | 39 | 0.0047 | 12.2 | 2.6 | 0.30 | 4,220 | 3,290 | 1.66 | 1.04 | 1.35 | 1,910 | 30.3 | 74 | 64 | 57 | 105 |
| 6 | 615 | 80 | 41 | 0.0046 | 15.2 | 3.3 | 0.37 | 354 | 4,530 | 3,670 | 1.12 | 1.61 | 2,040 | 28.0 | 72 | 61 | 54 | 113 |
| 7 | 617 | 80 | 39 | 0.0045 | 13.5 | 3.0 | 0.35 | 411 | 4,700 | 3,740 | 1.68 | 1.28 | 1,840 | 26.0 | 73 | 62 | 55 | 110 |
| 8 | 617 | 80 | 33 | 0.0040 | 12.0 | 3.0 | 0.36 | 502 | 5,090 | 3,740 | 0.92 | 1.10 | 1,800 | 20.7 | 73 | 65 | 56 | 106 |
| 9 | 606 | 0.0035 | 19.2 | 2.6 | 0.34 | 515 | 2,395 | 4,885 | 3,640 | 1.28 | 0.80 | 1.04 | 1,790 | 20.8 | 68 | 58 | 52 | 122 |
| 10 | 607 | 0.0042 | 21.9 | 5.3 | 0.46 | 263 | 3,110 | 5,650 | 4,380 | 1.80 | 1.20 | 1.43 | 3,040 | 36.2 | 30 | 30 | 25 | 202 |
| 11 | 597 | 0.0041 | 23.0 | 5.6 | 0.48 | 248 | 3,720 | 6,080 | 4,400 | 2.00 | 1.24 | 1.62 | 3,030 | 37.0 | 41 | 31 | 26 | 200 |
| 12 | 599 | 0.0041 | 26.5 | 5.0 | 0.46 | 220 | 3,060 | 6,940 | 4,310 | 1.80 | 1.14 | 1.47 | 2,840 | 40.7 | 43 | 31 | 26 | 200 |
| 13 | 601 | 0.0040 | 18.8 | 4.7 | 0.45 | 271 | 3,040 | 6,140 | 4,100 | 1.92 | 1.06 | 1.19 | 2,840 | 32.8 | 51 | 40 | 33 | 176 |
| 14 | 602 | 0.0040 | 18.8 | 3.0 | 0.38 | 298 | 2,500 | 4,240 | 3,370 | 1.62 | 1.34 | 1.48 | 1,560 | 29.7 | 62 | 54 | 47 | 137 |
| 15 | 638 | 0.0040 | 8.0 | 1.6 | 0.21 | 328 | 1,770 | 3,500 | 2,600 | 1.50 | 0.86 | 1.18 | 1,550 | 38.7 | 70 | 67 | 53 | 116 |
| 16 | 618 | 0.0054 | 13.2 | 2.4 | 0.31 | 338 | 3,020 | 5,700 | 4,390 | 1.24 | 1.04 | 1.14 | 1,480 | 41.9 | 78 | 67 | 60 | 95 |
| 17 | 637 | 0.0057 | 13.8 | 2.4 | 0.30 | 340 | 2,350 | 4,750 | 3,550 | 1.54 | 1.04 | 1.29 | 1,480 | 34.8 | 72 | 62 | 54 | 112 |
| 18 | 619 | 0.0053 | 15.6 | 2.9 | 0.35 | 365 | 2,800 | 4,210 | 3,500 | 1.86 | 0.92 | 1.39 | 1,710 | 32.8 | 73 | 63 | 58 | 106 |

SPRING-CUT WOOD.

| | | | | | | | | | | | | | | | | | | | | |
|----|-----|-----|----|--------|------|-----|------|-----|-------|-------|-------|------|------|------|-------|------|----|----|----|-----|
| 3 | 609 | 80 | 40 | 0.0045 | 14.1 | 3.1 | 0.35 | 396 | 2,590 | 4,920 | 3,760 | 1.68 | 1.12 | 1.40 | 1,990 | 27.2 | 71 | 61 | 55 | 113 |
| 4 | 608 | 80 | 38 | 0.0047 | 11.0 | 2.3 | 0.29 | 425 | 2,270 | 4,300 | 3,285 | 1.54 | .90 | 1.22 | 1,585 | 26.6 | 70 | 60 | 54 | 116 |
| 5 | 613 | 80 | 39 | 0.0047 | 12.2 | 2.6 | .31 | 350 | 2,420 | 4,290 | 3,290 | 1.66 | 1.04 | 1.35 | 1,610 | 30.3 | 74 | 64 | 57 | 105 |
| 6 | 615 | 80 | 41 | 0.0046 | 15.2 | 3.3 | .37 | 354 | 2,810 | 4,530 | 3,670 | 2.10 | 1.12 | 1.61 | 2,040 | 28.0 | 72 | 61 | 54 | 113 |
| 7 | 617 | 80 | 39 | 0.0045 | 13.5 | 3.0 | .35 | 411 | 2,790 | 4,500 | 3,740 | 1.68 | .88 | 1.28 | 1,840 | 26.0 | 73 | 62 | 55 | 110 |
| 8 | 606 | 80 | 33 | 0.0040 | 12.0 | 2.0 | .36 | 502 | 2,380 | 5,000 | 3,740 | 1.28 | .92 | 1.10 | 1,800 | 20.7 | 73 | 65 | 56 | 106 |
| 9 | 607 | 80 | 27 | 0.0035 | 19.2 | 2.6 | .34 | 515 | 2,395 | 4,885 | 3,640 | 1.28 | .80 | 1.04 | 1,790 | 20.8 | 68 | 58 | 52 | 122 |
| 10 | 597 | 100 | 48 | 0.0042 | 21.9 | 5.3 | .46 | 263 | 3,110 | 5,650 | 4,380 | 1.86 | 1.00 | 1.43 | 3,040 | 36.2 | 39 | 30 | 25 | 206 |
| 11 | 599 | 100 | 48 | 0.0041 | 23.0 | 5.6 | .48 | 248 | 2,720 | 6,080 | 4,400 | 2.00 | 1.24 | 1.62 | 3,030 | 37.0 | 41 | 31 | 26 | 202 |
| 12 | 600 | 100 | 53 | 0.0053 | 26.5 | 5.0 | .46 | 230 | 3,000 | 5,610 | 4,310 | 1.80 | 1.14 | 1.47 | 2,840 | 40.7 | 43 | 31 | 26 | 200 |
| 13 | 601 | 100 | 50 | 0.0040 | 18.8 | 4.7 | .45 | 271 | 3,060 | 4,940 | 4,000 | 1.32 | 1.06 | 1.19 | 2,840 | 32.8 | 51 | 40 | 33 | 176 |
| 14 | 602 | 100 | 42 | 0.0064 | 18.8 | 3.0 | .38 | 298 | 2,900 | 4,240 | 3,370 | 1.62 | 1.34 | 1.48 | 1,540 | 29.7 | 62 | 54 | 47 | 137 |
| 15 | 618 | 80 | 38 | 0.0050 | 8.0 | 1.6 | .21 | 328 | 1,770 | 3,560 | 2,660 | 1.50 | .86 | 1.18 | 1,960 | 38.7 | 70 | 61 | 53 | 116 |
| 16 | 618 | 80 | 42 | 0.0054 | 13.2 | 2.4 | .31 | 338 | 3,020 | 5,700 | 4,390 | 1.24 | 1.04 | 1.14 | 1,550 | 41.9 | 78 | 67 | 60 | 95 |
| 17 | 637 | 80 | 45 | 0.0057 | 15.6 | 2.9 | .34 | 340 | 2,350 | 4,750 | 3,550 | 1.54 | 1.04 | 1.18 | 1,480 | 34.8 | 72 | 62 | 54 | 112 |
| 18 | 619 | 80 | 45 | 0.0053 | 15.6 | 2.9 | .35 | 365 | 2,800 | 4,210 | 3,500 | 1.86 | .92 | 1.39 | 1,710 | 32.8 | 73 | 63 | 58 | 106 |

NOTE.—Pulp for No. 29 was made on a coarse-grit stone.

TABLE 49.—Quality tests—white pine.

| Grinder run No. | Paper machine run No. | Mullen test. | | | | Schopper tests. | | | | | | Tintometer indications. | | | | | | | | |
|-----------------|-----------------------|--------------|--------|--------------------------|------------|--|------------------|-------------|----------|------------|-------------|-------------------------|----------------------------------|--------------------------------|-------|--------|-------|--------|----|-----|
| | | Thickness. | Total. | Per 0.001 in. thickness. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | | Stretch. | | | Breaking weight per sq. mm. sec. | Breaking length per horsepower | Red. | Green. | Blue. | Black. | | |
| | | | | | | | Crosswise. | Lengthwise. | Average. | Crosswise. | Lengthwise. | Average. | | | | | | | | |
| 1 | 497 | 80 | 37 | 0.0039 | 14.7 | 3.8 | 0.40 | 305 | 2,380 | 4,620 | 3,500 | 2.42 | 1.22 | 1.82 | 1,810 | 28.7 | 76 | 66 | 60 | 98 |
| 2 | 501 | 80 | 37 | 0.0044 | 13.0 | 3.0 | .35 | 288 | 2,070 | 4,090 | 3,080 | 2.38 | 1.14 | 1.76 | 1,560 | 30.5 | 77 | 67 | 60 | 96 |
| 3 | 502 | 80 | 36 | 0.0043 | 12.6 | 2.9 | .35 | 257 | 2,120 | 4,010 | 3,060 | 2.18 | 1.16 | 1.67 | 1,530 | 34.0 | 79 | 70 | 64 | 87 |
| 4 | 503 | 80 | 38 | 0.0046 | 11.2 | 2.5 | .30 | 256 | 1,940 | 3,760 | 2,850 | 2.12 | 1.16 | 1.64 | 1,400 | 37.0 | 79 | 70 | 64 | 88 |
| 5 | 498 | 80 | 37 | 0.0042 | 17.3 | 4.1 | .47 | 236 | 2,280 | 4,890 | 3,580 | 2.12 | 1.12 | 1.62 | 1,790 | 32.2 | 77 | 67 | 61 | 95 |
| 6 | 504 | 80 | 34 | 0.0040 | 13.3 | 3.4 | .39 | 266 | 2,070 | 4,620 | 3,340 | 2.24 | 1.16 | 1.70 | 1,660 | 33.2 | 79 | 71 | 64 | 86 |
| 7 | 499 | 80 | 37 | 0.0043 | 14.2 | 3.3 | .38 | 298 | 2,230 | 4,290 | 3,260 | 2.06 | 1.22 | 1.64 | 1,610 | 33.2 | 79 | 69 | 62 | 90 |
| 8 | 500 | 80 | 38 | 0.0044 | 12.8 | 2.9 | .34 | 281 | 1,880 | 3,770 | 2,820 | 2.18 | 1.10 | 1.64 | 1,410 | 29.6 | 78 | 69 | 63 | 90 |
| 9 | 564 | 100 | 36 | 0.0034 | 18.2 | 5.3 | .50 | 259 | 2,270 | 4,760 | 3,520 | 2.50 | .84 | 1.67 | 2,260 | 27.1 | 57 | 43 | 36 | 164 |
| 10 | 561 | 100 | 35 | 0.0034 | 17.6 | 5.2 | .50 | 222 | 2,220 | 5,210 | 3,720 | 2.88 | 1.28 | 2.08 | 2,320 | 33.5 | 59 | 45 | 38 | 158 |
| 11 | 562 | 100 | 40 | 0.0039 | 19.6 | 5.1 | .49 | 221 | 2,310 | 5,260 | 3,780 | 3.76 | 1.58 | 2.67 | 2,320 | 34.8 | 59 | 43 | 36 | 162 |
| 12 | 503 | 100 | 36 | 0.0035 | 14.8 | 4.2 | .41 | 270 | 2,140 | 4,510 | 3,320 | 3.68 | 1.20 | 2.44 | 1,980 | 30.0 | 59 | 44 | 38 | 159 |

TABLE 50.—*Quality tests—Englemann spruce (Montana)*.

| Grinder run No. | Mullen test. | | | | Schopper tests. | | | | | | Tintometer indications. | | | | | | | | | |
|-----------------|-----------------------|-------------------------|------------------|------------|-----------------|---------|---------------------------|------------|--|------------------|-------------------------|---------|-----------|-----------|----------------------------------|---------------------------------|------|--------|-------|--------|
| | Paper machine run No. | Ground furnish in total | Weight per ream. | Thickness. | Total. | | Per 0.001 in. thick-ness. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | | Stretch. | | Breaking weight per sq. mm. sec. | Breaking length per horse-power | Red. | Green. | Blue. | Black. |
| | | | | | Points. | Points. | | | | Meters. | Meters. | Meters. | Per cent. | Per cent. | | | | | | |
| 1 | 555 | 80 | 37 | 0.0041 | 12.8 | 3.1 | 0.35 | 226 | 2,350 | 4,160 | 3,260 | 1.64 | 1.00 | 1.32 | 1,720 | 41.2 | 79 | 71 | 64 | 86 |
| 2 | 556 | 80 | 38 | 0.0040 | 10.0 | 2.5 | 0.29 | 229 | 2,110 | 3,790 | 2,950 | 1.28 | 0.84 | 1.06 | 1,440 | 44.5 | 84 | 74 | 65 | 77 |
| 3 | 568 | 80 | 38 | 0.0044 | 10.6 | 2.4 | 0.28 | 242 | 2,110 | 4,030 | 3,070 | 1.72 | 1.04 | 1.38 | 1,580 | 45.5 | 82 | 74 | 65 | 77 |
| 4 | 570 | 80 | 37 | 0.0034 | 7.1 | 2.1 | 0.26 | 248 | 2,090 | 3,660 | 2,880 | 1.24 | 0.74 | 1.09 | 1,340 | 49.6 | 83 | 71 | 66 | 87 |
| 5 | 573 | 80 | 32 | 0.0039 | 8.7 | 2.2 | 0.27 | 282 | 2,320 | 3,710 | 3,020 | 1.26 | 0.82 | 1.04 | 1,460 | 39.6 | 79 | 70 | 64 | 87 |
| 6 | 567 | 80 | 33 | 0.0038 | 11.2 | 2.9 | 0.34 | 187 | 2,530 | 3,540 | 2,720 | 2.20 | 1.10 | 1.65 | 1,760 | 52.6 | 82 | 73 | 66 | 79 |
| 7 | 569 | 80 | 35 | 0.0042 | 9.7 | 2.9 | 0.28 | 198 | 2,210 | 3,550 | 2,880 | 2.71 | 0.86 | 1.30 | 1,390 | 55.1 | 84 | 71 | 67 | 75 |
| 8 | 554 | 100 | 37 | 0.0028 | 21.5 | 7.7 | 0.65 | 121 | 3,160 | 6,260 | 4,710 | 2.48 | 0.92 | 1.70 | 3,230 | 59.9 | 89 | 36 | 32 | 183 |
| 9 | 555 | 100 | 37 | 0.0034 | 22.9 | 6.6 | 0.62 | 128 | 3,030 | 5,730 | 4,250 | 3.16 | 1.30 | 2.23 | 3,070 | 58.7 | 55 | 42 | 35 | 168 |
| 10 | 571 | 100 | 41 | 0.0039 | 23.5 | 6.9 | 0.57 | 125 | 2,770 | 5,730 | 4,250 | 2.62 | 1.04 | 1.83 | 2,590 | 59.7 | 59 | 47 | 40 | 154 |
| 11 | 572 | 80 | 36 | 0.0044 | 10.8 | 2.6 | 0.30 | 220 | 2,140 | 4,160 | 3,130 | 1.38 | 0.92 | 1.15 | 1,570 | 47.8 | 77 | 69 | 60 | 94 |
| 12 | 572 | 80 | 33 | 0.0038 | 10.0 | 2.6 | 0.30 | 195 | 2,430 | 4,360 | 3,400 | 1.52 | 0.86 | 1.19 | 1,760 | 58.1 | 83 | 75 | 67 | 75 |
| 13 | 574 | 80 | 29 | 0.0043 | 10.9 | 2.5 | 0.30 | 193 | 2,440 | 4,180 | 3,310 | 1.40 | 0.92 | 1.16 | 1,800 | 57.1 | 84 | 75 | 69 | 72 |
| 14 | 667 | 80 | 26 | 0.0033 | 8.9 | 2.7 | 0.31 | 277 | 2,950 | 4,780 | 3,800 | 1.18 | 0.78 | 0.98 | 1,800 | 44.9 | 71 | 65 | 60 | 104 |
| 15 | 673 | 80 | 45 | 0.0047 | 15.7 | 3.3 | 0.35 | 210 | 2,890 | 5,150 | 4,020 | 1.94 | 1.02 | 1.48 | 1,170 | 54.7 | 80 | 72 | 67 | 81 |
| 16 | 675 | 80 | 41 | 0.0046 | 14.5 | 3.1 | 0.35 | 185 | 2,850 | 5,280 | 4,060 | 1.82 | 1.00 | 1.41 | 1,920 | 62.8 | 82 | 77 | 70 | 71 |
| 17 | 674 | 80 | 38 | 0.0043 | 13.2 | 3.1 | 0.35 | 211 | 2,820 | 5,110 | 3,980 | 2.14 | 0.98 | 1.56 | 1,900 | 53.6 | 79 | 72 | 63 | 86 |
| 18 | 669 | 80 | 40 | 0.0047 | 14.3 | 3.0 | 0.36 | 213 | 2,650 | 5,130 | 3,880 | 2.14 | 0.92 | 1.24 | 1,860 | 50.6 | 75 | 71 | 64 | 80 |
| 19 | 677 | 80 | 36 | 0.0043 | 10.5 | 2.4 | 0.29 | 235 | 2,540 | 4,640 | 3,590 | 1.42 | 0.86 | 1.14 | 1,540 | 52.5 | 81 | 73 | 66 | 80 |

TABLE 51.—*Quality tests—Engelmann spruce (Colorado).*

| Grinder run No. | Paper machine run No. | Ground wood in total furnish. | Weight per ream. | Thickness. | Mullen test. | | | | Schooper tests. | | | | | | Tintometer indications. | | | |
|-----------------|-----------------------|-------------------------------|------------------|------------|--------------|--------------------------|------------|--|------------------|---------|----------|-------------|----------------------------------|---------------------------------|-------------------------|--------|--------|--------|
| | | | | | Total. | Per 0.001 in. thickness. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | Stretch. | | Breaking weight per sq. mm. sec. | Breaking length per horsepower. | Red. | Green. | Blue. | Black. |
| | | | | | Points. | Points. | Point. | | Meters. | Meters. | Per ct. | Lengthwise. | Per ct. | Meters. | Parts. | Parts. | Parts. | Parts. |
| 1 | 466 | 80 | 35 | 0.0039 | 15.6 | 4.0 | 0.45 | 246 | 2,880 | 5,390 | 2.00 | 1.18 | 1.59 | 2,190 | 75 | 67 | 62 | 96 |
| 2 | 467 | 80 | 30 | .0034 | 10.2 | 3.0 | .34 | 267 | 2,560 | 4,360 | 2.12 | 1.14 | 1.63 | 1,830 | 79 | 73 | 67 | 81 |
| 3 | 468 | 80 | 35 | .0040 | 11.8 | 3.0 | .34 | 251 | 2,580 | 4,680 | 1.78 | 1.08 | 1.43 | 1,910 | 79 | 73 | 67 | 81 |
| 4 | 740 | 80 | 37 | .0044 | 10.7 | 2.5 | .29 | 346 | 2,150 | 4,630 | 1.36 | .92 | 1.14 | 1,560 | 72 | 65 | 60 | 103 |
| 5 | 469 | 80 | 31 | .0040 | 9.0 | 2.3 | .29 | 266 | 2,400 | 4,050 | 1.64 | 1.02 | 1.33 | 1,540 | 81 | 72 | 66 | 81 |
| 6 | 470 | 80 | 32 | .0038 | 10.2 | 2.7 | .32 | 252 | 2,400 | 4,450 | 1.58 | 1.06 | 1.32 | 1,710 | 81 | 74 | 67 | 78 |
| 7 | 471 | 80 | 31 | .0036 | 9.2 | 2.6 | .30 | 260 | 2,500 | 4,070 | 1.64 | 1.04 | 1.34 | 1,610 | 81 | 73 | 67 | 79 |
| 8 | 472 | 80 | 32 | .0038 | 10.6 | 2.8 | .33 | 230 | 2,500 | 4,200 | 1.96 | 1.08 | 1.52 | 1,660 | 79 | 72 | 65 | 84 |
| 9 | 515 | 80 | 36 | .0042 | 13.2 | 3.1 | .27 | 335 | 2,200 | 4,890 | 1.86 | 1.10 | 1.48 | 1,870 | 79 | 70 | 64 | 87 |
| 10 | 516 | 80 | 35 | .0040 | 11.4 | 2.9 | .33 | 226 | 2,140 | 4,230 | 1.66 | 1.02 | 1.34 | 1,630 | 82 | 73 | 65 | 80 |
| 11 | 517 | 80 | 35 | .0043 | 12.1 | 2.8 | .30 | 204 | 2,380 | 3,360 | 1.56 | .92 | 1.24 | 1,440 | 84 | 77 | 69 | 70 |
| 12 | 538 | 80 | 36 | .0045 | 10.7 | 2.4 | .35 | 223 | 2,170 | 3,920 | 1.78 | .82 | 1.30 | 1,440 | 84 | 77 | 69 | 70 |
| 13 | 539 | 100 | 48 | .0040 | 34.4 | 8.7 | .72 | 194 | 2,720 | 6,150 | 3.36 | 1.22 | 2.30 | 3,200 | 55 | 41 | 35 | 169 |
| 14 | 541 | 100 | 40 | .0035 | 26.2 | 8.0 | .66 | 157 | 2,750 | 5,540 | 4.40 | 1.06 | 2.31 | 3,020 | 52 | 39 | 31 | 178 |
| 15 | 540 | 100 | 37 | .0031 | 22.6 | 7.2 | .61 | 155 | 2,510 | 6,030 | 4.270 | 1.12 | 1.88 | 3,050 | 52 | 38 | 30 | 180 |
| 16 | 541 | 100 | 41 | .0039 | 23.3 | 6.0 | .57 | 160 | 2,310 | 5,930 | 4.120 | .96 | 1.55 | 2,850 | 54 | 41 | 33 | 172 |
| 17 | 524 | 100 | 45 | .0039 | 31.4 | 8.1 | .70 | 140 | 3,220 | 7,410 | 5.320 | 1.10 | 1.86 | 3,560 | 60 | 47 | 41 | 152 |
| 18 | 525 | 100 | 46 | .0045 | 25.8 | 5.8 | .56 | 154 | 3,220 | 6,770 | 5.000 | 1.12 | 1.63 | 3,000 | 58.0 | 47 | 41 | 152 |
| 19 | 116 | 80 | 36 | .0032 | 9.3 | 2.9 | .26 | 292 | 1,580 | 2,630 | 2.110 | .58 | .92 | 1,480 | 68 | 60 | 60 | 112 |
| 19 | 650 | 80 | 32 | .0040 | 9.7 | 2.4 | .30 | 253 | 2,140 | 4,480 | 1.62 | .92 | 1.27 | 1,370 | 76 | 71 | 64 | 89 |

1 Commercial.

TABLE 52.—Quality tests—Sitka spruce.

| Grinder run No. | Paper machine run No. | Ground wood in total furnish. | Weight per ream. | Thickness. | Mullen test. | | | | Schopper tests. | | | | | | Tintometer indications. | | | | | |
|-----------------|-----------------------|-------------------------------|------------------|------------|--------------|---------------------------|------------|--|------------------|-------------|----------|-----------|-------------|----------|--------------------------|----------------------------------|------|--------|-------|--------|
| | | | | | Total. | Per 0.001 in. thick-ness. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | | Stretch. | | | Breaking length per ton. | Breaking weight per sq. mm. sec. | Red. | Green. | Blue. | Black. |
| | | | | | | | | | Meters. | Lengthwise. | Average. | Per cent. | Lengthwise. | Average. |  |  |  |  |  |  | Per cent. | Grams. | Meters. |
| 2 | 211 | 80 | 30 | 0.0034 | 13.4 | 4.0 | 0.45 | 262 | 2,950 | 5,400 | 4,170 | 2.24 | 1.14 | 1.09 | 35.4 | 1,990 | 66 | 58 | 53 | 123 |
| 5 | 263 | 100 | 51 | 0.0041 | 28.6 | 6.5 | .56 | 234 | 3,070 | 6,000 | 4,540 | 2.66 | 1.58 | 2.12 | 34.6 | 2,940 | 44 | 28 | 22 | 206 |
| 6 | 264 | 100 | 51 | 0.0041 | 33.8 | 8.2 | .66 | 195 | 3,120 | 6,700 | 4,910 | 2.25 | 1.44 | 1.85 | 38.1 | 3,280 | 38 | 23 | 18 | 221 |
| 7 | 265 | 100 | 42 | 0.0034 | 24.2 | 7.0 | .58 | 195 | 3,380 | 6,850 | 5,120 | 2.10 | 1.46 | 1.78 | 45.1 | 3,380 | 35 | 21 | 16 | 228 |
| 8 | 365 | 80 | 35 | 0.0037 | 17.8 | 4.8 | .51 | 245 | 2,930 | 5,400 | 4,160 | 3.32 | 1.56 | 2.44 | 33.2 | 2,040 | 77 | 65 | 57 | 101 |
| 9 | 366 | 80 | 39 | 0.0041 | 18.1 | 4.4 | .46 | 244 | 2,940 | 5,610 | 4,320 | 2.38 | 1.54 | 1.96 | 38.5 | 2,070 | 74 | 63 | 56 | 107 |
| 10 | 367 | 80 | 36 | 0.0038 | 16.2 | 4.3 | .45 | 240 | 2,800 | 5,240 | 4,050 | 2.74 | 1.44 | 2.09 | 37.5 | 1,960 | 72 | 62 | 56 | 110 |
| 11 | 368 | 80 | 39 | 0.0043 | 17.0 | 4.0 | .44 | 239 | 2,640 | 5,010 | 3,820 | 3.06 | 1.56 | 2.31 | 36.4 | 1,850 | 72 | 61 | 55 | 112 |
| 12 | 388 | 80 | 36 | 0.0036 | 18.3 | 5.1 | .51 | 415 | 3,360 | 6,140 | 4,750 | 2.02 | 1.18 | 1.73 | 22.4 | 2,480 | 66 | 54 | 50 | 130 |
| 13 | 389 | 80 | 38 | 0.0038 | 20.2 | 5.3 | .53 | 294 | 3,490 | 6,120 | 4,800 | 2.34 | 1.12 | 1.60 | 30.8 | 2,560 | 71 | 60 | 53 | 116 |
| 14 | 370 | 80 | 33 | 0.0035 | 16.2 | 4.6 | .49 | 286 | 3,020 | 5,720 | 4,370 | 2.60 | 1.46 | 2.03 | 31.2 | 2,090 | 68 | 57 | 51 | 124 |
| 15 | 343 | 80 | 36 | 0.0038 | 15.4 | 4.1 | .43 | 335 | 3,200 | 5,760 | 4,480 | 1.86 | 1.26 | 1.56 | 31.1 | 2,250 | 71 | 59 | 50 | 120 |
| 16 | 324 | 81 | 32 | 0.0032 | 15.4 | 4.9 | .48 | 479 | 2,800 | 5,570 | 4,180 | 2.44 | 1.72 | 2.08 | 19.5 | 2,240 | 60 | 50 | 43 | 147 |
| 17 | 295 | 100 | 48 | 0.0037 | 27.2 | 7.3 | .56 | 423 | 3,190 | 6,160 | 4,680 | 2.76 | 1.76 | 2.26 | 35 | 3,400 | 35 | 21 | 16 | 228 |
| 18 | 325 | 80 | 26 | 0.0027 | 10.6 | 3.9 | .41 | 976 | 3,190 | 5,510 | 4,350 | 2.36 | 1.62 | 2.26 | 10.9 | 2,300 | 64 | 52 | 45 | 139 |
| 19 | 13 | 75 | 40 | 0.0034 | 9.8 | 2.9 | .25 | 408 | 1,450 | 3,640 | 2,540 | 1.24 | .98 | 1.11 | 24.9 | 1,720 | 65 | 60 | 60 | 115 |
| 19 | 446 | 80 | 33 | 0.0040 | 12.6 | 3.2 | .38 | 208 | 2,640 | 4,610 | 3,620 | 2.44 | 1.16 | 1.80 | 35.5 | 1,600 | 73 | 61 | 50 | 116 |

1 Commercial.

TABLE 53.—Quality tests—white birch.

| Grinder run No. | Paper machine run No. | Ground wood in to- tal furnish. | Weight per ream. | Thickness. | Mullen test. | | | Horsepower per ton divided by strength factor. | Breaking length. | | | Stretch. | | Breaking weight per sq. mm. sectional area. | | Breaking length per horsepower. | Tintometer indications. | | | | | |
|-----------------|-----------------------|------------------------------------|------------------|------------|--------------|-----------------------------|------------|--|------------------|---------|-------------|----------|------------|---|----------|------------------------------------|-------------------------|---------|------|--------|-------|--------|
| | | | | | Total. | Per 0.001 in. thickness. | Per pound. | | Crosswise. | | Lengthwise. | Average. | Crosswise. | Lengthwise. | Average. | | Grams. | Meters. | Red. | Green. | Blue. | Black. |
| | | | | | | | | | Meters. | Meters. |  |  |  |  |  |  |  |  |  |  |  |  | Per ct. | Per ct. |
| 1 | 237 | 80 | 32 | 0.0029 | 15.8 | 5.5 | 0.49 | 135 | 2,470 | 5,130 | 3,800 | 1.52 | 1.12 | 1.32 | 2,121 | 57.4 | 34 | 20 | 16 | 230 | | |
| 2 | 216 | 80 | 33 | 0.0046 | 6.4 | 1.4 | 0.19 | 596 | 1,660 | 2,630 | 2,140 | 1.34 | 0.94 | 1.14 | 840 | 18.9 | 74 | 63 | 58 | 105 | | |
| 3 | 322 | 100 | 48 | 0.0042 | 24.7 | 5.8 | 0.51 | 150 | 2,580 | 4,600 | 3,590 | 2.96 | 1.26 | 2.11 | 2,310 | 46.7 | 36 | 22 | 16 | 226 | | |
| 4 | 278 | 100 | 52 | 0.0049 | 24.0 | 4.9 | 0.46 | 155 | 2,730 | 3,800 | 3,260 | 2.24 | 1.30 | 1.77 | 1,990 | 45.8 | 38 | 24 | 19 | 219 | | |
| 5 | 274 | 100 | 57 | 0.0053 | 27.8 | 5.2 | 0.49 | 152 | 2,950 | 4,880 | 3,920 | 2.72 | 1.24 | 1.98 | 2,300 | 52.5 | 39 | 24 | 19 | 218 | | |
| 6 | 425 | 80 | 34 | 0.0046 | 9.8 | 2.1 | 0.29 | 687 | 2,190 | 3,870 | 3,030 | 1.58 | 0.92 | 1.25 | 1,280 | 15.7 | 69 | 59 | 54 | 118 | | |
| 7 | 427 | 80 | 35 | 0.0046 | 8.6 | 1.9 | 0.25 | 629 | 2,010 | 3,540 | 2,780 | 1.44 | 0.76 | 1.10 | 1,110 | 17.7 | 66 | 56 | 60 | 118 | | |
| 8 | 426 | 80 | 35 | 0.0049 | 8.7 | 1.8 | 0.25 | 519 | 2,110 | 3,520 | 2,820 | 1.02 | 0.66 | 0.84 | 960 | 21.8 | 73 | 60 | 47 | 132 | | |
| 9 | 428 | 80 | 34 | 0.0049 | 7.4 | 1.5 | 0.22 | 512 | 1,810 | 2,900 | 2,360 | 1.10 | 0.64 | 0.87 | 1,130 | 21.0 | 66 | 55 | 53 | 114 | | |

TABLE 54.—Quality tests—aspens.

| Grinder run No. | Paper machine run No. | Ground wood in total furnish. | Weight per ream. | Thickness. | Mullen test. | | | Horsepower per ton divided by strength factor. | Breaking length. | | | Stretch. | | | Breaking weight per sq. mm. sectional area. | Breaking length per horsepower. | Tintometer indications. | | | |
|-----------------|-----------------------|-------------------------------|------------------|------------|--------------|--------------------------|------------|--|------------------|-------------|----------|------------|-------------|----------|---|---------------------------------|-------------------------|--------|--------|--------|
| | | | | | Total. | Per 0.001 in. thickness. | Per pound. | | Crosswise. | Lengthwise. | Average. | Crosswise. | Lengthwise. | Average. | | | Parts. | Parts. | Parts. | Parts. |
| | | | | | | | | | | | | | | | | | | | | |
| 1 | 234 | 80 | 32 | 0.0028 | 12.8 | 4.6 | 0.40 | 158 | 2,080 | 4,130 | 3,110 | 1.66 | 1.24 | 1.45 | 1,760 | 49.1 | 44 | 30 | 23 | 203 |
| 2 | 217 | 80 | 33 | 0.0042 | 9.8 | 2.3 | 0.30 | 464 | 2,240 | 3,880 | 3,060 | 1.70 | 1.10 | 1.40 | 1,340 | 22.0 | 73 | 63 | 56 | 108 |
| 3 | 262 | 100 | 61 | 0.0049 | 28.2 | 5.7 | 0.46 | 131 | 2,810 | 4,960 | 3,880 | 3.06 | 1.30 | 2.18 | 3,680 | 61.2 | 37 | 23 | 18 | 222 |
| 4 | 261 | 100 | 55 | 0.0045 | 29.9 | 6.6 | 0.54 | 138 | 3,290 | 5,850 | 4,570 | 2.72 | 1.32 | 2.02 | 3,140 | 64.6 | 36 | 23 | 18 | 223 |
| 5 | 260 | 100 | 63 | 0.0052 | 32.2 | 6.2 | 0.51 | 118 | 2,970 | 5,240 | 4,100 | 2.94 | 1.32 | 2.13 | 2,820 | 67.8 | 38 | 23 | 18 | 221 |
| 6 | 436 | 80 | 31 | 0.0039 | 11.0 | 2.0 | 0.35 | 870 | 2,760 | 4,970 | 3,860 | 1.48 | 0.84 | 1.16 | 1,680 | 12.3 | 72 | 64 | 56 | 108 |
| 7 | 437 | 80 | 29 | 0.0038 | 9.2 | 2.4 | 0.32 | 690 | 2,460 | 4,120 | 3,290 | 1.20 | 0.80 | 1.00 | 1,390 | 14.9 | 73 | 63 | 56 | 108 |
| 8 | 438 | 80 | 28 | 0.0038 | 8.4 | 2.2 | 0.30 | 606 | 2,440 | 4,250 | 3,340 | 1.24 | 0.78 | 1.01 | 1,390 | 18.4 | 69 | 62 | 54 | 115 |
| 9 | 439 | 80 | 34 | 0.0045 | 9.8 | 2.2 | 0.29 | 559 | 2,400 | 3,500 | 2,870 | 1.58 | 0.80 | 1.19 | 1,190 | 17.7 | 76 | 66 | 57 | 101 |
| 10 | 440 | 80 | 35 | 0.0040 | 14.2 | 3.6 | 0.41 | 740 | 2,690 | 4,870 | 3,780 | 1.52 | 1.04 | 1.28 | 1,780 | 8.8 | 72 | 60 | 50 | 118 |
| 11 | 441 | 80 | 32 | 0.0039 | 12.0 | 3.1 | 0.38 | 781 | 2,740 | 4,640 | 3,690 | 1.94 | 0.98 | 1.46 | 1,680 | 12.4 | 73 | 60 | 53 | 114 |
| 12 | 442 | 80 | 33 | 0.0041 | 12.2 | 3.0 | 0.37 | 625 | 2,660 | 4,270 | 3,460 | 1.86 | 1.06 | 1.46 | 1,550 | 15.0 | 73 | 67 | 49 | 111 |
| 13 | 443 | 80 | 32 | 0.0041 | 10.9 | 2.7 | 0.34 | 509 | 2,640 | 4,490 | 3,560 | 1.48 | 0.80 | 1.14 | 1,520 | 20.6 | 73 | 61 | 52 | 114 |

TABLE 55.—Quality tests—black gum.

| Grinder run No. | Paper machine run No. | Ground wood in total furnish. | Weight per ream. | Thickness. | Mullen test. | | | | Schopper tests. | | | | | | Tintometer indications. | | | |
|-----------------|-----------------------|-------------------------------|------------------|------------|--------------|--------------------------|------------|--|------------------|-------------|----------|---------|----------------------------------|--------------------------|-------------------------|--------|-------|--------|
| | | | | | Total. | Per 0.001 in. thickness. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | Stretch. | | Breaking weight per sq. mm. sec. | Breaking length per ton. | Red. | Green. | Blue. | Black. |
| | | | | | Points. | Points. | Points. | Points. | Meters. | Lengthwise. | Average. | Per ct. | Per ct. | | | | | |
| 1 | 727 | 80 | 34 | 0.0043 | 10.3 | 2.1 | 0.30 | 870 | 2,100 | 5,130 | 3,660 | 1.18 | 1.00 | 1.09 | 76 | 68 | 64 | 92 |
| 2 | 732 | 80 | 35 | 0.0045 | 8.7 | 2.2 | .28 | 818 | 1,800 | 4,270 | 3,040 | 1.42 | 1.16 | 1.29 | 80 | 71 | 65 | 84 |
| 3 | 728 | 80 | 35 | 0.0046 | 8.6 | 1.8 | .25 | 567 | 1,860 | 3,950 | 2,900 | 1.38 | 1.00 | 1.19 | 80 | 72 | 66 | 82 |
| 4 | 629 | 80 | 37 | 0.0052 | 9.5 | 1.8 | .26 | 658 | 1,760 | 3,280 | 2,520 | 1.84 | .86 | 1.25 | 81 | 74 | 70 | 75 |
| 5 | 738 | 80 | 33 | 0.0048 | 8.6 | 1.8 | .26 | 667 | 1,680 | 3,830 | 2,760 | 1.28 | .96 | 1.12 | 76 | 66 | 64 | 94 |
| 6 | 651 | 80 | 43 | 0.0055 | 10.8 | 2.0 | .23 | 787 | 2,080 | 3,880 | 2,880 | 1.84 | 1.06 | 1.45 | 77 | 71 | 66 | 86 |
| 7 | 630 | 80 | 41 | 0.0056 | 8.9 | 1.6 | .22 | 777 | 1,540 | 3,000 | 2,270 | 1.56 | .96 | 1.26 | 81 | 72 | 68 | 79 |
| 8 | 628 | 80 | 47 | 0.0067 | 7.6 | 1.1 | .16 | 465 | 1,210 | 2,110 | 1,660 | 1.34 | .84 | 1.09 | 85 | 74 | 67 | 74 |
| 9 | 688 | 100 | 42 | 0.0056 | 7.4 | 1.3 | .18 | 401 | 1,410 | 2,460 | 1,940 | 1.22 | .86 | 1.04 | 84 | 50 | 50 | 126 |
| 10 | 693 | 100 | 48 | 0.0049 | 21.2 | 4.4 | .44 | 190 | 2,370 | 5,460 | 3,920 | 1.86 | 1.40 | 1.63 | 68 | 33 | 31 | 191 |
| 11 | 695 | 100 | 43 | 0.0043 | 18.0 | 4.2 | .42 | 229 | 2,460 | 5,240 | 3,850 | 2.08 | 1.14 | 1.61 | 45 | 49 | 37 | 182 |
| 12 | 694 | 100 | 53 | 0.0054 | 20.9 | 3.9 | .39 | 207 | 2,560 | 4,890 | 3,720 | 2.58 | 1.42 | 2.00 | 50 | 38 | 33 | 179 |
| 13 | 656 | 80 | 44 | 0.0060 | 6.5 | 1.1 | .15 | 545 | 1,370 | 2,440 | 1,900 | 1.08 | .90 | .98 | 77 | 68 | 64 | 91 |
| 14 | 711 | 80 | 47 | 0.0066 | 5.1 | .8 | .11 | 644 | 1,980 | 1,820 | 1,400 | 1.00 | .66 | .83 | 82 | 73 | 67 | 78 |

NOTE.—Pulp for No. 14 was made on a coarse-grit stone.

TABLE 56.—*Quality tests.*

MIXTURE OF WOODS.

| Grinder run No. | Paper machine run No. | Ground wood in total furnish. | Weight per ream. | Thickness. | Mullen test. | | | | Schopper tests. | | | | | | Tintometer indications. | | | | | |
|-----------------|-----------------------|-------------------------------|------------------|------------|--------------|--------------------------|------------|--|------------------|-------------|----------|------------|-------------|----------|----------------------------------|---------------------------------|--------|--------|--------|--------|
| | | | | | Total. | Per 0.001 in. thickness. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | | Stretch. | | | Breaking weight per sq. mm. sec. | Breaking length per horsepower. | Red. | Green. | Blue. | Black. |
| | | | | | | | | | Crosswise. | Lengthwise. | Average. | Crosswise. | Lengthwise. | Average. | | | | | | |
| | | | | | Points. | Points. | Points. | | Meters. | Meters. | Meters. | Per ct. | Per ct. | Per ct. | Grams. | Meters. | Parts. | Parts. | Parts. | |
| 50 | 312 | 100 | 42 | 0.0040 | 17.4 | 4.4 | 0.41 | 227 | 2,580 | 4,780 | 3,680 | 2.62 | 1.44 | 2.03 | 2,210 | 39.4 | 39 | 16 | 222 | |
| 51 | 314 | 100 | 42 | .0039 | 16.5 | 4.2 | .39 | 273 | 2,360 | 4,560 | 3,400 | 2.28 | 1.58 | 1.93 | 2,060 | 32.5 | 42 | 17 | 217 | |
| 52 | 313 | 100 | 49 | .0044 | 19.6 | 4.4 | .40 | 254 | 2,640 | 5,020 | 3,830 | 3.08 | 1.50 | 2.29 | 2,330 | 37.8 | 38 | 15 | 225 | |

WESTERN YELLOW PINE.

| | | | | | | | | | | | | | | | | | | | |
|----|-----|----|----|--------|------|-----|------|-----|-------|-------|-------|------|-----|------|-------|------|----|----|-----|
| 20 | 407 | 80 | 32 | 0.0039 | 13.8 | 3.5 | 0.43 | 227 | 2,980 | 4,850 | 3,920 | 1.72 | .90 | 1.31 | 1,720 | 40.2 | 79 | 66 | 98 |
| 21 | 424 | 80 | 34 | .0042 | 12.6 | 3.0 | .37 | 272 | 2,650 | 5,230 | 3,940 | 1.48 | .96 | 1.22 | 1,680 | 39.2 | 75 | 64 | 107 |
| 22 | 410 | 80 | 35 | .0045 | 13.5 | 3.0 | .39 | 267 | 2,790 | 5,060 | 3,920 | 1.56 | .84 | 1.20 | 1,650 | 37.7 | 70 | 59 | 119 |
| 23 | 411 | 80 | 31 | .0038 | 12.8 | 3.4 | .41 | 262 | 3,000 | 5,200 | 4,130 | 1.46 | .82 | 1.14 | 1,780 | 38.5 | 70 | 59 | 120 |
| 24 | 406 | 80 | 32 | .0041 | 11.4 | 2.8 | .36 | 330 | 2,440 | 4,270 | 3,360 | 1.52 | .90 | 1.21 | 1,380 | 28.3 | 67 | 54 | 134 |
| 25 | 412 | 80 | 32 | .0041 | 11.4 | 2.8 | .36 | 321 | 2,740 | 4,290 | 3,520 | 1.76 | .80 | 1.28 | 1,490 | 30.4 | 69 | 56 | 128 |
| 26 | 413 | 80 | 36 | .0046 | 13.6 | 3.0 | .38 | 300 | 2,770 | 4,970 | 3,870 | 1.68 | .92 | 1.30 | 1,700 | 34.0 | 68 | 55 | 130 |

WESTERN HEMLOCK.

| | | | | | | | | | | | | | | | | | | | |
|----|-----|----|----|--------|------|-----|------|-----|-------|-------|-------|------|------|------|-------|------|----|----|----|
| 15 | 404 | 80 | 31 | 0.0035 | 18.2 | 5.2 | 0.59 | 233 | 3,310 | 5,730 | 4,520 | 2.32 | 1.14 | 1.73 | 2,140 | 33.0 | 65 | 54 | 48 |
| 16 | 414 | 80 | 37 | .0040 | 19.5 | 4.9 | .53 | 272 | 3,300 | 6,510 | 4,950 | 2.14 | 1.20 | 1.67 | 2,480 | 34.4 | 64 | 54 | 47 |
| 17 | 415 | 80 | 35 | .0036 | 21.2 | 5.9 | .60 | 247 | 4,040 | 6,620 | 5,330 | 2.26 | 1.02 | 1.64 | 2,710 | 36.0 | 65 | 55 | 49 |

MONTANA LODGEPOLE PINE.

| | | | | | | | | | | | | | | | | | | | | |
|----|-----|----|----|--------|------|-----|------|-----|-------|-------|-------|------|------|------|-------|------|----|----|----|-----|
| 24 | 417 | 80 | 35 | 0.0040 | 13.8 | 3.4 | 0.39 | 289 | 2,520 | 4,760 | 3,640 | 2.76 | 1.48 | 2.12 | 1,760 | 31.2 | 58 | 47 | 40 | 155 |
| 25 | 416 | 80 | 36 | .0042 | 15.4 | 3.7 | .43 | 284 | 2,440 | 4,640 | 3,540 | 2.78 | 1.44 | 2.11 | 1,620 | 29.0 | 65 | 54 | 47 | 134 |

CALIFORNIA LODGEPOLE PINE.

| | | | | | | | | | | | | | | | | | | | | |
|----|-----|----|----|--------|------|-----|------|-----|-------|-------|-------|------|------|------|-------|------|----|----|----|-----|
| 22 | 418 | 80 | 35 | 0.0041 | 15.5 | 3.8 | 0.44 | 398 | 3,080 | 5,810 | 4,450 | 1.98 | 1.12 | 1.55 | 2,080 | 25.4 | 67 | 57 | 49 | 127 |
| 23 | 419 | 80 | 31 | .0038 | 12.0 | 3.1 | .38 | 388 | 2,770 | 5,120 | 3,940 | 2.02 | 1.06 | 1.54 | 1,770 | 26.7 | 67 | 56 | 49 | 128 |
| 24 | 420 | 80 | 30 | .0035 | 13.3 | 3.8 | .44 | 400 | 3,160 | 5,860 | 4,510 | 1.70 | 1.00 | 1.35 | 1,960 | 25.7 | 73 | 61 | 52 | 114 |
| 25 | 421 | 80 | 35 | .0038 | 16.6 | 4.4 | .48 | 346 | 3,290 | 5,820 | 4,560 | 2.16 | 1.02 | 1.59 | 2,290 | 27.5 | 69 | 58 | 51 | 122 |

GREEN BALSAM.

| | | | | | | | | | | | | | | | | | | | | |
|----|-----|----|----|--------|------|-----|------|-----|-------|-------|-------|------|------|------|-------|------|----|----|----|-----|
| 23 | 110 | 75 | 33 | 0.0029 | 8.4 | 2.9 | 0.26 | 368 | 1,820 | 3,460 | 2,640 | 1.12 | .74 | .93 | 1,690 | 27.6 | 63 | 57 | 57 | 123 |
| 23 | 453 | 80 | 33 | .0040 | 14.2 | 3.5 | .43 | 222 | 2,880 | 4,820 | 3,850 | 1.90 | 1.00 | 1.45 | 1,720 | 40.2 | 83 | 77 | 66 | 74 |

HEMLOCK.

| | | | | | | | | | | | | | | | | | | | | |
|----|-----|----|----|--------|------|-----|------|-----|-------|-------|-------|------|------|------|-------|------|----|----|----|-----|
| 63 | 19 | 75 | 36 | 0.0031 | 9.8 | 3.2 | 0.27 | 470 | 1,790 | 3,830 | 2,810 | 1.12 | .84 | .98 | 1,860 | 22.1 | 55 | 50 | 50 | 145 |
| 63 | 452 | 80 | 34 | .0039 | 14.5 | 3.7 | .43 | 296 | 2,940 | 5,100 | 4,020 | 1.82 | 1.00 | 1.41 | 1,870 | 31.7 | 78 | 66 | 60 | 96 |

TAMARACK.

| | | | | | | | | | | | | | | | | | | | | |
|----|-----|----|----|--------|------|-----|------|-----|-------|-------|-------|------|------|------|-------|------|----|----|----|-----|
| 54 | 112 | 75 | 36 | 0.0034 | 9.9 | 2.9 | 0.27 | 327 | 1,860 | 3,560 | 2,710 | 1.14 | .78 | .96 | 1,800 | 30.7 | 59 | 54 | 54 | 133 |
| 54 | 455 | 80 | 37 | .0046 | 13.6 | 3.0 | .37 | 238 | 2,520 | 4,580 | 3,550 | 1.78 | 1.06 | 1.42 | 1,650 | 40.2 | 77 | 66 | 61 | 96 |

1 Commercial.

TABLE 57.—*Commercial runs.*

| Stock No. of pulp. | Kind of wood. | Run No. | Kind of burr. | Number of pockets used. | Pressure on 14-inch cylinder. | Pressure per square inch of pocket area. | Revolutions per minute. | Peripheral speed. | Average horsepower to grinder. | Maximum horsepower to grinder. | Bone-dry pulp in 24 hours. | Horsepower per ton bone-dry pulp in 24 hours. | Solid ground in 24 hours. | Weight per cubic foot bone-dry wood. | Average diameter of wood. | Moisture in wood. | Bone-dry pulp per 100 cubic feet solid ground wood. | Efficiency of conversion. | Screenings per 100 cubic feet solid ground wood. | Average temperature of bone-dry. | F. | Horsepower divided by pressure X speed. | |
|--------------------|----------------------------|---------|--|-------------------------|-------------------------------|--|-------------------------|-------------------|--------------------------------|--------------------------------|----------------------------|---|---------------------------|--------------------------------------|---------------------------|-------------------|---|---------------------------|--|----------------------------------|------|---|---------|
| | Green jack pine. | 14 | Diamond point, cut 6 to inch | 3 | Lbs. per sq. in. | Lbs. | Feet per minute. | | | Tons | | | | Cu. ft. | Lbs. | In. | Per cent. | Lbs. | Per cent. | | | | |
| | Seasoned jack pine. | 14 | do. | 3 | 50 20.5 | 171 | 2,400 | 436 | 7.030 | 64.3 | | | | | | | | 2,170 | 85.5 | | 148 | 0.00885 | |
| | Hemlock. | 14 | do. | 3 | 50 20.5 | 171 | 2,400 | 447 | 6.230 | 72.7 | | | | | | | | 2,210 | 86.4 | | 145 | 0.00907 | |
| | do. | 14-1 | Spiral, cut 10 to inch. | 3 | 50 20.5 | 175 | 2,435 | 349 | 447.3 | 103.1 | | | | | | | | 2,078 | 82.6 | 10.6 | 171 | 0.00999 | |
| | do. | 14-1 | do. | 3 | 50 20.5 | 175 | 2,432 | 368 | 404.4 | 115 | | | | | | | | 2,047 | 83.7 | 18.5 | 167 | 0.00740 | |
| | do. | 23 | Straight, cut 10 to inch. | 3 | 40 16.4 | 176 | 2,450 | 306 | 426.3 | 455 | | | | | | | | 2,083 | 84.0 | 23.5 | 168 | 0.00762 | |
| | do. | 23 | Diamond point, 10 to inch. | 3 | 40 16.4 | 176 | 2,440 | 301 | 380.3 | 390 | | | | | | | | 2,105 | 84.9 | 23.5 | 173 | 0.00750 | |
| | do. | 30 | Spiral, cut 10 to inch; straight, cut 4 to inch. | 3 | 40 16.4 | 176 | 2,432 | 331 | 392.3 | 725 | | | | | | | | 2,102 | 84.7 | 17.0 | 177 | 0.00633 | |
| | Hemlock Spruce. | 46A | Straight, cut 3 to inch; spiral, cut 12 to inch. | 3 | 50 20.5 | 175 | 2,445 | 427 | 507.5 | 175 | | | | | | | | 2,030 | 83.1 | 16.3 | 169 | 0.00653 | |
| | Jack pine. | 51 | do. | 3 | 50 20.5 | 175 | 2,445 | 443 | 528.5 | 575 | | | | | | | | 2,232 | 83.2 | 17.4 | 171 | 0.00884 | |
| | Hemlock Spruce. | 24 | do. | 3 | 40 16.4 | 175 | 2,445 | 395 | 4.305 | 91.8 | | | | | | | | 37.16 | 86.7 | 14.86 | 176 | 0.00924 | |
| | Jack pine. | 1 | do. | 3 | 45 16.40 | 175 | 2,445 | 401 | 4.810 | 83.5 | | | | | | | | 28.90 | 87.4 | 17.2 | 173 | 0.00825 | |
| | Spruce. | 52 | do. | 3 | 50 20.5 | 175 | 2,445 | 414 | 404.4 | 310 | | | | | | | | 2,230 | 86.2 | 17.6 | 178 | 0.00835 | |
| | Jack pine. | 50 | do. | 3 | 50 20.5 | 175 | 2,445 | 418 | 484.4 | 370 | | | | | | | | 46.90 | 86.1 | 11.2 | 180 | 0.00833 | |
| 1 | Hemlock. | 2 | do. | 3 | 40 16.4 | 200 | 2,795 | 402 | 4.120 | 97.5 | | | | | | | | 39.33 | 88.5 | 13.75 | 168 | 0.01002 | |
| 2 | Spruce. | 222 | do. | 3 | 80 32.8 | 225 | 3,069 | 474 | 566.6 | 610 | | | | | | | | 32.24 | 94.6 | 14.65 | 146 | 0.00470 | |
| 3 | Western hemlock. | 18 | do. | 3 | 50 20.5 | 225 | 3,069 | 479 | 566.3 | 800 | | | | | | | | 24.20 | 91.0 | 10.80 | 169 | 0.00760 | |
| 4 | Sitka spruce. | 3 | do. | 3 | 50 20.5 | 225 | 3,069 | 458 | 541.4 | 405 | | | | | | | | 22.60 | 89.9 | 32.50 | 168 | 0.00935 | |
| 4 | Montana lodgepole pine. | 26 | do. | 3 | 55 22.55 | 225 | 3,069 | 500 | 581.3 | 630 | | | | | | | | 23.60 | 88.3 | 12.20 | 173 | 0.00723 | |
| 5 | Western yellow pine. | 27 | Spiral, cut 8 to inch; straight, cut 10 to inch. | 3 | 40 16.4 | 225 | 3,069 | 455 | 541.7 | 055 | | | | | | | | 26.98 | 90.0 | 30.20 | 137 | 0.00904 | |
| 6 | Green balsam fir. | 22 | do. | 3 | 40 16.4 | 225 | 3,069 | 481 | 543.5 | 330 | | | | | | | | 44 | 95.0 | 8.45 | 151 | 0.00955 | |
| 7 | California lodgepole pine. | 26 | do. | 2 | 80 32.8 | 225 | 3,069 | 496 | 580.6 | 405 | | | | | | | | 25.30 | 1,996 | 21.6 | 156 | 0.00492 | |
| 8 | Red fir. | 19 | do. | 2 | 80 32.8 | 225 | 3,069 | 483 | 580.5 | 710 | | | | | | | | 26.50 | 2,000 | 92.7 | 12.6 | 158 | 0.00479 |

| | | | | | | | | | | | | | | | | | | | | | |
|----|--------------------------------|----|---|---|----|------|-----|-------|-----|-----|-------|-------|-------|-------|-----|-------|-------|------|-------|-----|--------|
| 9 | Spruce..... | 63 | do..... | 3 | 50 | 20.5 | 225 | 5,069 | 516 | 592 | 4.075 | 127.0 | 179.0 | 24.93 | 51 | 33.55 | 2,280 | 92.1 | 12.00 | 177 | .00820 |
| 10 | Hemlock..... | 23 | do..... | 3 | 40 | 16.4 | 225 | 3,069 | 476 | 542 | 4.980 | 95.6 | 179.0 | 24.47 | 51 | 44.50 | 2,160 | 96.2 | 11.50 | 157 | .00945 |
| 11 | Green balsam spruce..... | 53 | do..... | 3 | 40 | 16.4 | 225 | 3,069 | 430 | 505 | 4.510 | 95.4 | 209.0 | 24.93 | 51 | 61.66 | 2,780 | 85.6 | 10.10 | 170 | .00854 |
| 12 | Tamarack..... | 54 | do..... | 2 | 65 | 26.6 | 225 | 3,069 | 415 | 503 | 4.705 | 88.2 | 185.0 | 30.70 | 51 | 25.25 | 2,410 | 89.4 | 13.75 | 157 | .00509 |
| 13 | Spruce..... | 16 | do..... | 3 | 50 | 20.5 | 225 | 3,020 | 393 | 504 | 4.275 | 92.0 | 205.0 | 23.74 | 51 | 25.00 | 2,410 | 89.4 | 13.75 | 157 | .00509 |
| 14 | Noble fir..... | 13 | Spiral, cut 12 to inch; straight, cut 3 to inch. | 3 | 50 | 20.5 | 225 | 3,020 | 393 | 504 | 4.275 | 92.0 | 205.0 | 23.74 | 51 | 25.00 | 2,410 | 89.4 | 13.75 | 157 | .00509 |
| 15 | Alpine fir..... | 35 | Spiral, cut 8 to inch; straight, cut 10 to inch. | 3 | 50 | 20.5 | 225 | 3,020 | 430 | 579 | 5.110 | 84.0 | 479.0 | 21.60 | (1) | 34.80 | 1,933 | 91.9 | 14.8 | 151 | .00636 |
| 16 | White fir..... | 19 | do..... | 2 | 45 | 18.5 | 225 | 3,020 | 384 | 477 | 4.775 | 80.4 | 498.0 | 20.80 | (1) | 43.00 | 2,020 | 92.2 | 16.4 | 162 | .00687 |
| 17 | Engelmann spruce, Colorado. | 15 | do..... | 2 | 70 | 28.7 | 225 | 3,020 | 368 | 479 | 4.840 | 76.0 | 488.0 | 21.17 | 61 | 58.26 | 1,980 | 93.6 | 12.8 | 153 | .00425 |
| 18 | Amabilis fir..... | 15 | do..... | 2 | 80 | 32.8 | 225 | 3,020 | 397 | 502 | 4.900 | 81.0 | 485.0 | 21.10 | (1) | 25.27 | 2,020 | 95.7 | 10.3 | 159 | .00401 |

1 Split.

TABLE 58.—Quality tests of papers made from "commercial" pulps.

| Stock No. of pulp. | Kind of wood. | Grinder run No. | Paper machine run No. | Ground wood in total furnish. | Weight per ream. | Thickness. | Mullen test. | | | | Schopper tests. | | | | Tintometer indications. | | | | | | |
|--------------------|-----------------------------------|-----------------|-----------------------|-------------------------------|------------------|------------|--------------|---------------------------|------------|--|------------------|----------|----------|-------------|-----------------------------------|---------------------------------|------|--------|-------|--------|----------|
| | | | | | | | Total. | Per 0.001 in. thick-ness. | Per pound. | Horsepower per ton divided by strength factor. | Breaking length. | | Stretch. | | Breaking weight per sq. mm., sec. | Breaking length per horsepower. | Rod. | Green. | Blue. | Black. | |
| | | | | | | | | | | | Meters. | Average. | P. c. | Lengthwise. | | | | | | | Average. |
| 1 | White spruce..... | 222 | 444 | 11 | 32 | 0.0040 | 11.9 | 3.0 | 0.37 | 194 | 2,730 | 4,700 | 3,720 | 1.68 | 0.88 | 1,610 | 51.9 | 72 | 60 | 52 | 116 |
| 2 | Western hemlock..... | 18 | 445 | 11 | 75 | 0.0029 | 8.8 | 3.0 | 0.28 | 256 | 1,880 | 3,740 | 2,810 | 1.26 | 0.84 | 1,760 | 39.2 | 65 | 58 | 58 | 118 |
| 3 | Sitka spruce..... | 19 | 446 | 12 | 75 | 0.0028 | 10.1 | 3.6 | 0.52 | 242 | 3,000 | 5,720 | 4,300 | 2.36 | 1.46 | 2,080 | 34.6 | 52 | 45 | 43 | 139 |
| 4 | Lodgepole pine (Montana)..... | 20 | 447 | 13 | 75 | 0.0034 | 12.6 | 3.2 | 0.31 | 268 | 2,430 | 4,290 | 3,360 | 1.92 | 1.14 | 2,160 | 26.7 | 66 | 53 | 53 | 138 |
| 5 | Western yellow pine..... | 27 | 448 | 14 | 75 | 0.0048 | 13.8 | 2.9 | 0.25 | 408 | 2,640 | 4,610 | 3,620 | 2.44 | 1.16 | 1,800 | 35.5 | 73 | 61 | 50 | 115 |
| 6 | Balsam fir..... | 22 | 449 | 15 | 75 | 0.0033 | 13.2 | 3.6 | 0.42 | 328 | 1,840 | 4,940 | 3,890 | 2.24 | 1.11 | 1,720 | 24.9 | 65 | 60 | 60 | 116 |
| 7 | Lodgepole pine (California)..... | 26 | 450 | 16 | 75 | 0.0028 | 8.9 | 3.2 | 0.27 | 510 | 1,870 | 3,980 | 2,920 | 1.20 | 0.76 | 1,980 | 28.2 | 71 | 57 | 46 | 128 |
| 8 | Red fir..... | 19 | 451 | 17 | 75 | 0.0034 | 9.4 | 2.0 | 0.26 | 248 | 2,150 | 3,500 | 2,780 | 1.92 | 1.42 | 1,980 | 43.1 | 74 | 62 | 51 | 113 |
| 9 | Hemlock (one-half spruce)..... | 63 | 452 | 18 | 75 | 0.0031 | 9.8 | 3.1 | 0.17 | 379 | 1,150 | 2,710 | 1,930 | 1.78 | 0.74 | 1,040 | 29.9 | 61 | 56 | 56 | 127 |
| 10 | Balsam fir (one-half spruce)..... | 23 | 453 | 19 | 75 | 0.0039 | 14.5 | 2.4 | 0.22 | 410 | 1,680 | 4,650 | 3,640 | 2.16 | 1.18 | 1,630 | 40.3 | 80 | 69 | 60 | 91 |
| 11 | Tamarack..... | 53 | 454 | 20 | 75 | 0.0031 | 9.8 | 3.2 | 0.27 | 470 | 1,790 | 3,830 | 2,810 | 1.12 | 0.84 | 1,880 | 22.1 | 55 | 50 | 50 | 145 |
| 12 | Tamarack (one-half spruce)..... | 54 | 455 | 21 | 80 | 0.0046 | 13.6 | 4.8 | 0.49 | 188 | 2,880 | 4,820 | 3,850 | 1.90 | 1.45 | 1,720 | 40.2 | 83 | 77 | 66 | 74 |
| 13 | Noble fir..... | 16 | 647 | 22 | 80 | 0.0028 | 12.6 | 4.5 | 0.36 | 256 | 1,820 | 3,400 | 2,640 | 1.54 | 0.98 | 1,690 | 27.6 | 63 | 57 | 57 | 123 |
| 14 | Alpine fir..... | 13 | 640 | 23 | 80 | 0.0043 | 9.9 | 2.9 | 0.32 | 298 | 2,250 | 3,950 | 3,100 | 1.52 | 1.26 | 1,490 | 32.5 | 76 | 63 | 56 | 105 |
| 15 | White fir..... | 35 | 649 | 24 | 80 | 0.0041 | 8.2 | 2.0 | 0.25 | 322 | 2,520 | 4,580 | 3,550 | 1.78 | 1.06 | 1,400 | 24.1 | 52 | 46 | 46 | 156 |
| 16 | Engelmann spruce (Colorado)..... | 19 | 650 | 25 | 80 | 0.0034 | 9.9 | 2.7 | 0.32 | 237 | 1,860 | 3,560 | 2,710 | 1.14 | 0.78 | 1,960 | 30.7 | 59 | 54 | 54 | 133 |
| 17 | Amabilis fir..... | 15 | 653 | 26 | 80 | 0.0033 | 13.8 | 3.7 | 0.42 | 193 | 3,370 | 6,240 | 4,800 | 1.06 | 1.04 | 2,610 | 52.2 | 72 | 65 | 60 | 103 |
| | | | | | | | | | | | 2,200 | 4,630 | 3,440 | 1.60 | 0.96 | 1,280 | 37.4 | 63 | 56 | 55 | 126 |
| | | | | | | | | | | | 2,830 | 5,120 | 3,980 | 1.70 | 1.06 | 1,720 | 47.4 | 76 | 70 | 67 | 87 |
| | | | | | | | | | | | 1,670 | 3,020 | 2,340 | 1.16 | 0.68 | 1,620 | 27.8 | 68 | 61 | 63 | 108 |
| | | | | | | | | | | | 2,300 | 3,920 | 2,790 | 1.32 | 0.78 | 1,220 | 34.7 | 75 | 66 | 58 | 101 |
| | | | | | | | | | | | 2,070 | 3,510 | 2,790 | 1.18 | 0.90 | 1,370 | 26.5 | 72 | 65 | 57 | 126 |
| | | | | | | | | | | | 2,440 | 4,480 | 3,130 | 1.18 | 0.99 | 1,370 | 26.5 | 76 | 71 | 64 | 89 |
| | | | | | | | | | | | 2,140 | 4,480 | 3,310 | 1.62 | 0.92 | 1,271 | 43.5 | 60 | 53 | 54 | 112 |
| | | | | | | | | | | | 1,580 | 2,630 | 2,110 | 1.26 | 0.58 | 1,480 | 27.8 | 68 | 60 | 60 | 100 |
| | | | | | | | | | | | 2,770 | 5,130 | 3,960 | 2.74 | 1.38 | 2,070 | 43.7 | 72 | 63 | 63 | 100 |
| | | | | | | | | | | | 1,870 | 3,700 | 2,780 | 1.28 | 0.74 | 1,860 | 34.3 | 68 | 61 | 60 | 111 |

APPENDIX B.

(Containing the following paper samples.)

| Kind of wood used. | Untreated wood. | | | Cooked wood. |
|----------------------------------|-------------------------------|---------------------------|-------------------------|-----------------|
| | Grinder run No. (Exp. paper). | Stock No. Unprinted news. | Stock No. Printed news. | Grinder run No. |
| White spruce..... | 222 | 1 | 1 | 190 |
| Western hemlock..... | 18 | 2 | 2 | 9 |
| Sitka spruce..... | 19 | 3 | 3 | 6 |
| Lodgepole pine (Montana)..... | 26 | 4 | 4 | 14 |
| Western yellow pine..... | 27 | 5 | 5 | 8 |
| Balsam fir..... | 22 | 6 | 6 | 27 |
| Lodgepole pine (California)..... | 23 | 10 | 10 | |
| Red fir..... | 26 | 7 | 7 | 1 |
| Hemlock..... | 19 | 8 | 8 | 2 |
| Tamarack..... | 63 | 9 | 9 | 161 |
| Noble fir..... | 53 | 11 | 11 | 27 |
| Alpine fir..... | 54 | 12 | 12 | |
| White fir..... | 16 | 13 | 13 | 11 |
| Engelmann spruce (Colorado)..... | 13 | 14 | 14 | 12 |
| Amabilis fir..... | 35 | 15 | 15 | 224 |
| Jack pine..... | 19 | 16 | 16 | 14 |
| White pine..... | 15 | 17 | 17 | 10 |
| Aspen..... | 27 | ..... | ..... | 30 |
| Birch..... | 8 | ..... | ..... | 11 |
| Black gum..... | 2 | ..... | ..... | 3 |
| Loblolly pine (fall cut)..... | 9 | ..... | ..... | 5 |
| Loblolly pine (spring cut)..... | 3 | ..... | ..... | 10 |
| Lowland fir..... | 6 | ..... | ..... | 19 |
| Engelmann spruce (Montana)..... | 23 | ..... | ..... | 18 |
| Western larch..... | 13 | ..... | ..... | 2 |
| | 16 | ..... | ..... | 10 |
| | 8 | ..... | ..... | 1 |

¹ Or No. 62.

² Or No. 10.



White Spine

Copyright No. 255

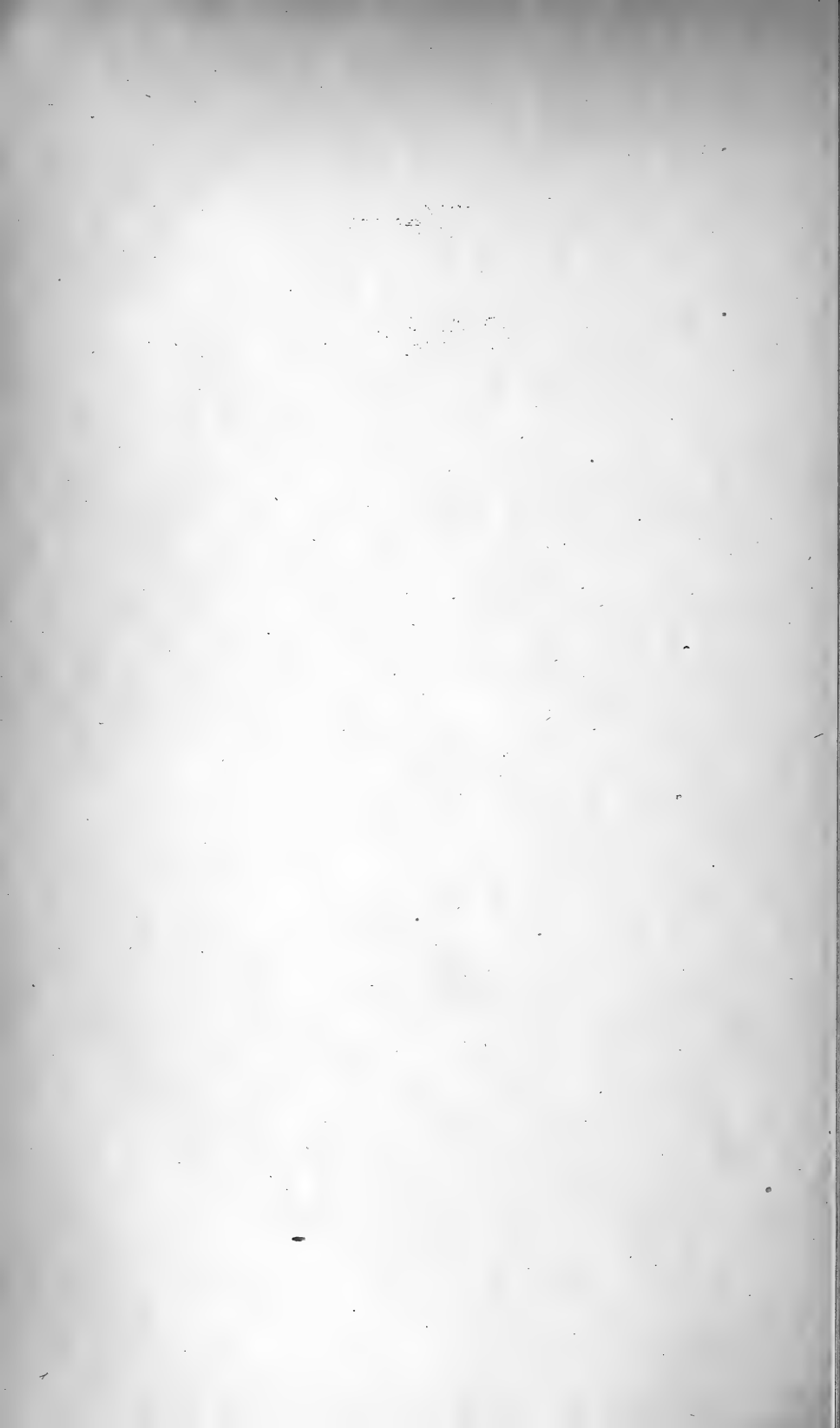
White Spruce.

Grinder Run No. 222.



Western Hemlock.

Grinder Run No. 18.



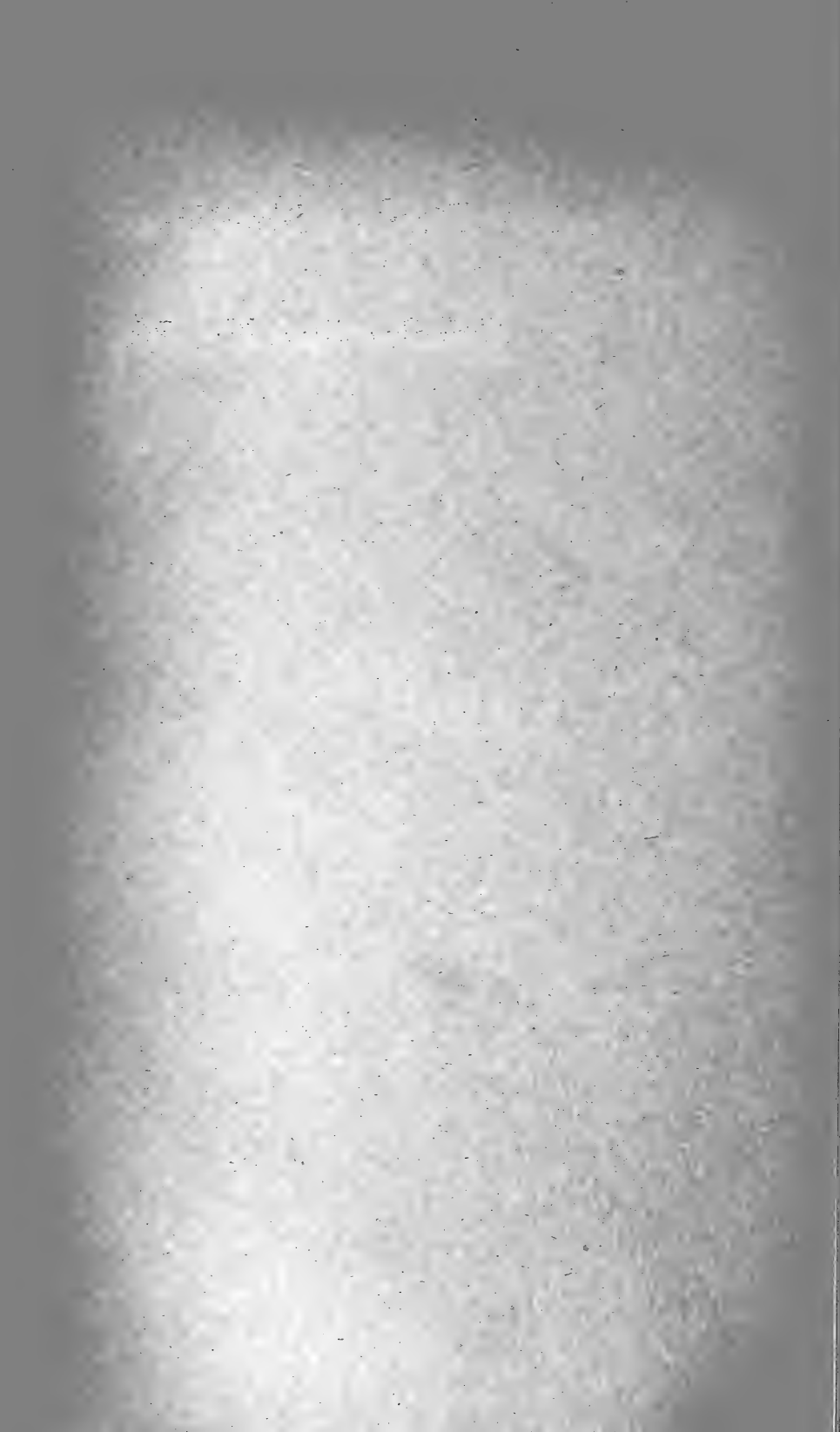
Sitka Spruce.

Grinder Run No. 19.



Lodgepole Pine. --- Montana..

Grinder Run No. 26.



Western Yellow Pine.

Grinder Run No. 27.

10

11

Balsam Fir.

Grinder Run No. 22.

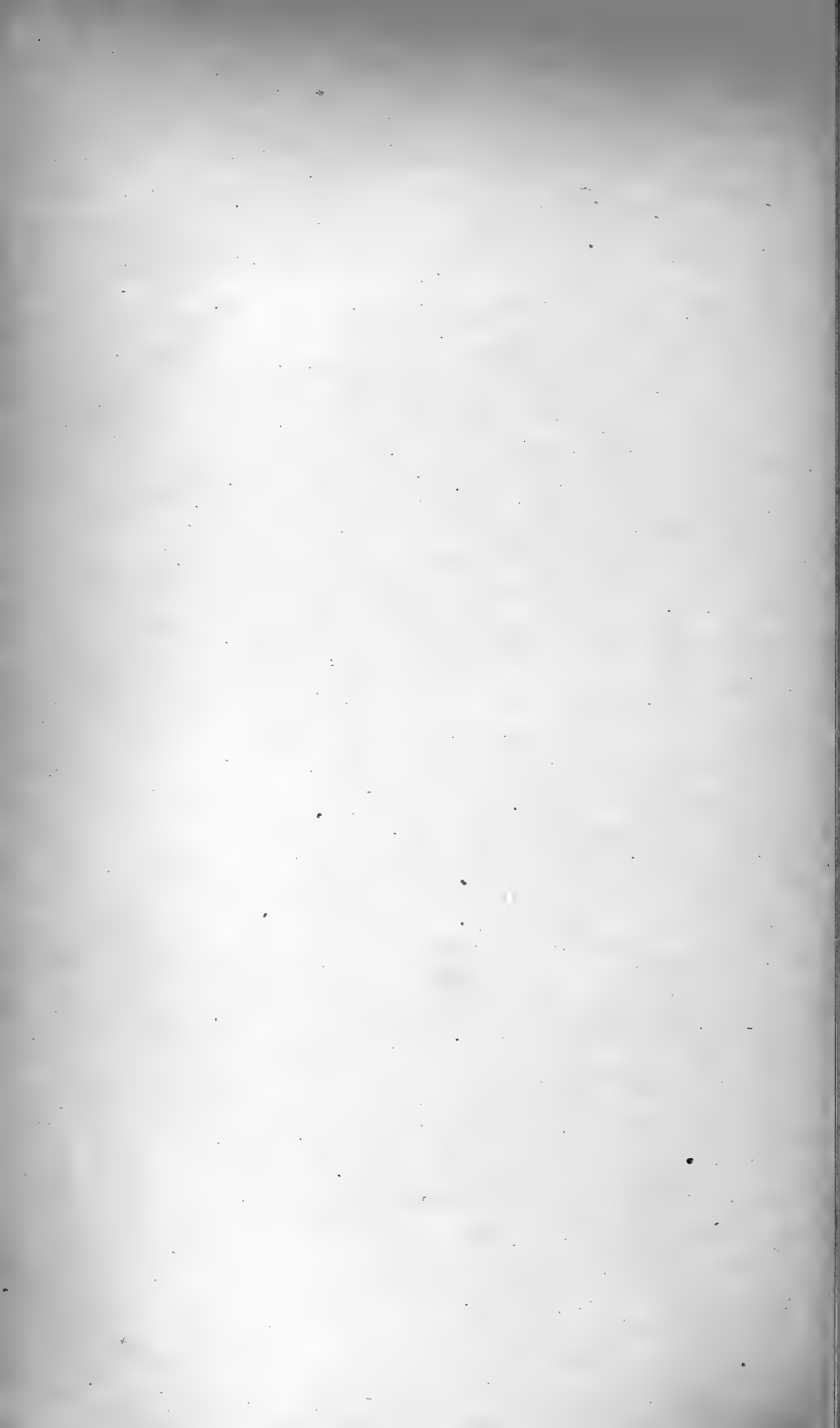
Balsam Fir.

Grinder Run No. 23.



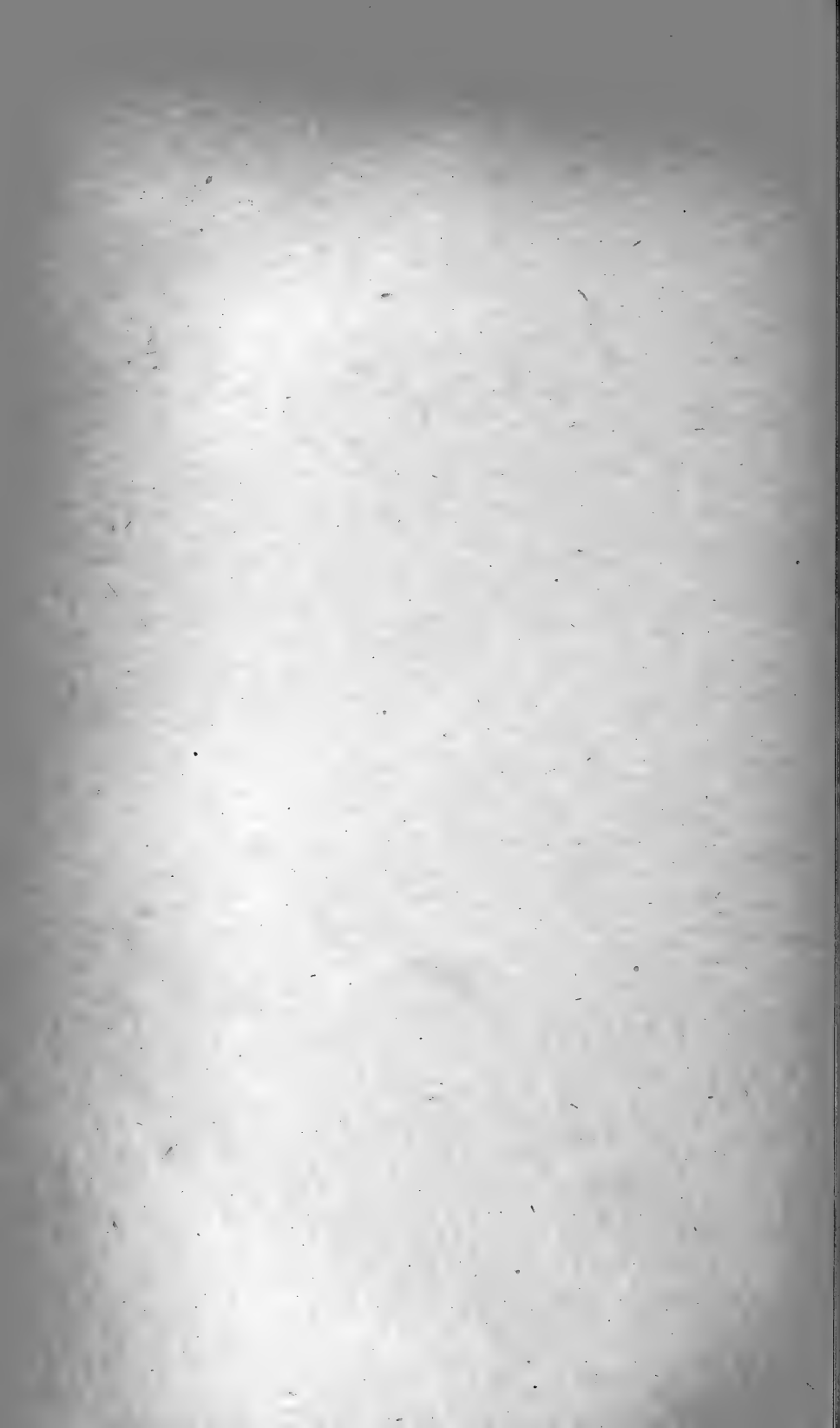
Lodgepole Pine. --- California.

Grinder Run No. 26.



Red Fir.

Grinder Run No. 19.



Hemlock.

Grinder Run No. 63.



Tamarack.

Grinder Run No. 53.



Tamarack.

Grinder Run No. 54.



Noble Fir.

Grinder Run No. 16.



Alpine Fir.

Grinder Run No. 13.



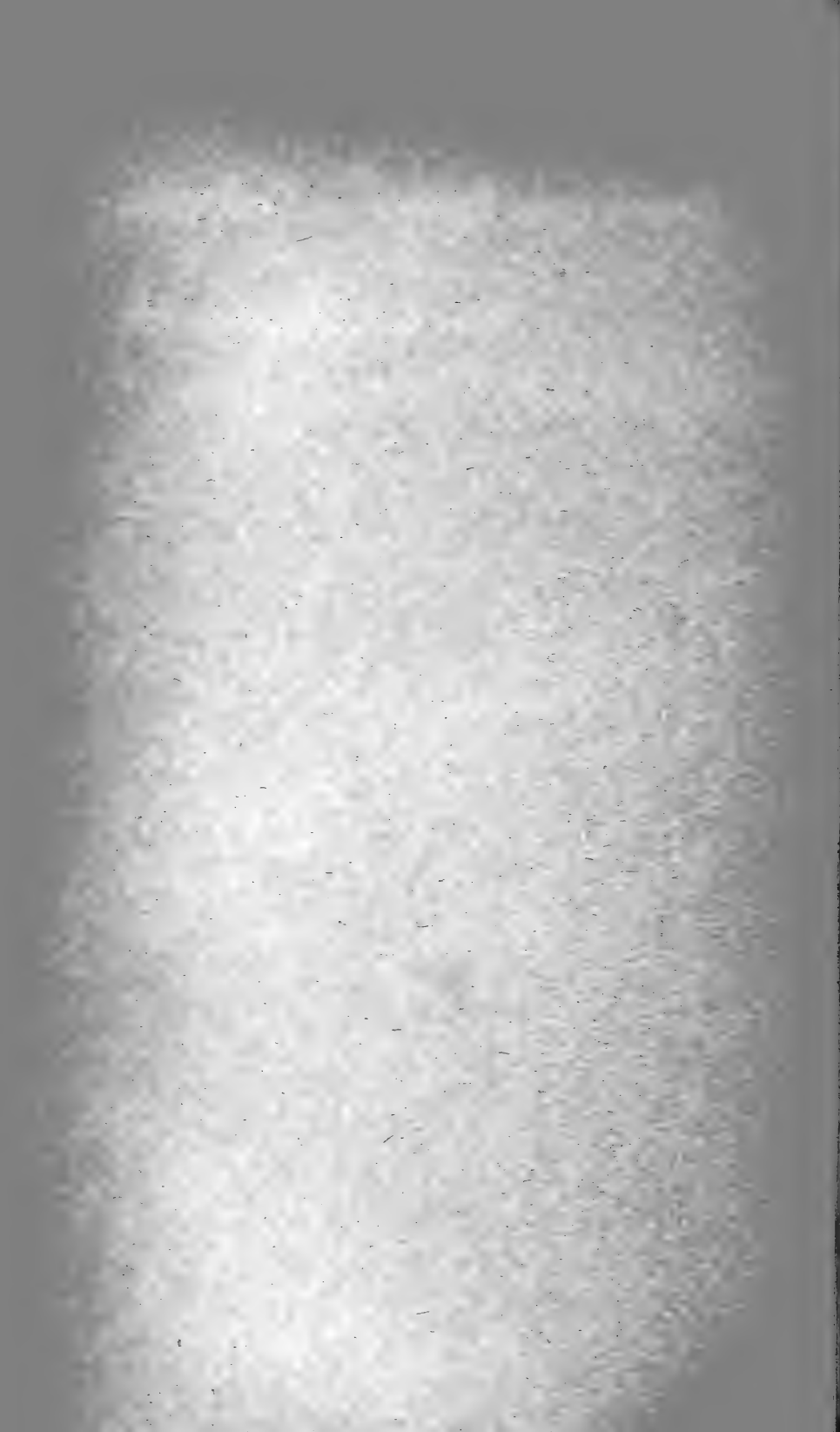
White Fir.

Grinder Run No. 35.



Engelmann Spruce --- Colorado.

Grinder Run No. 19.



Amabilis Fir.

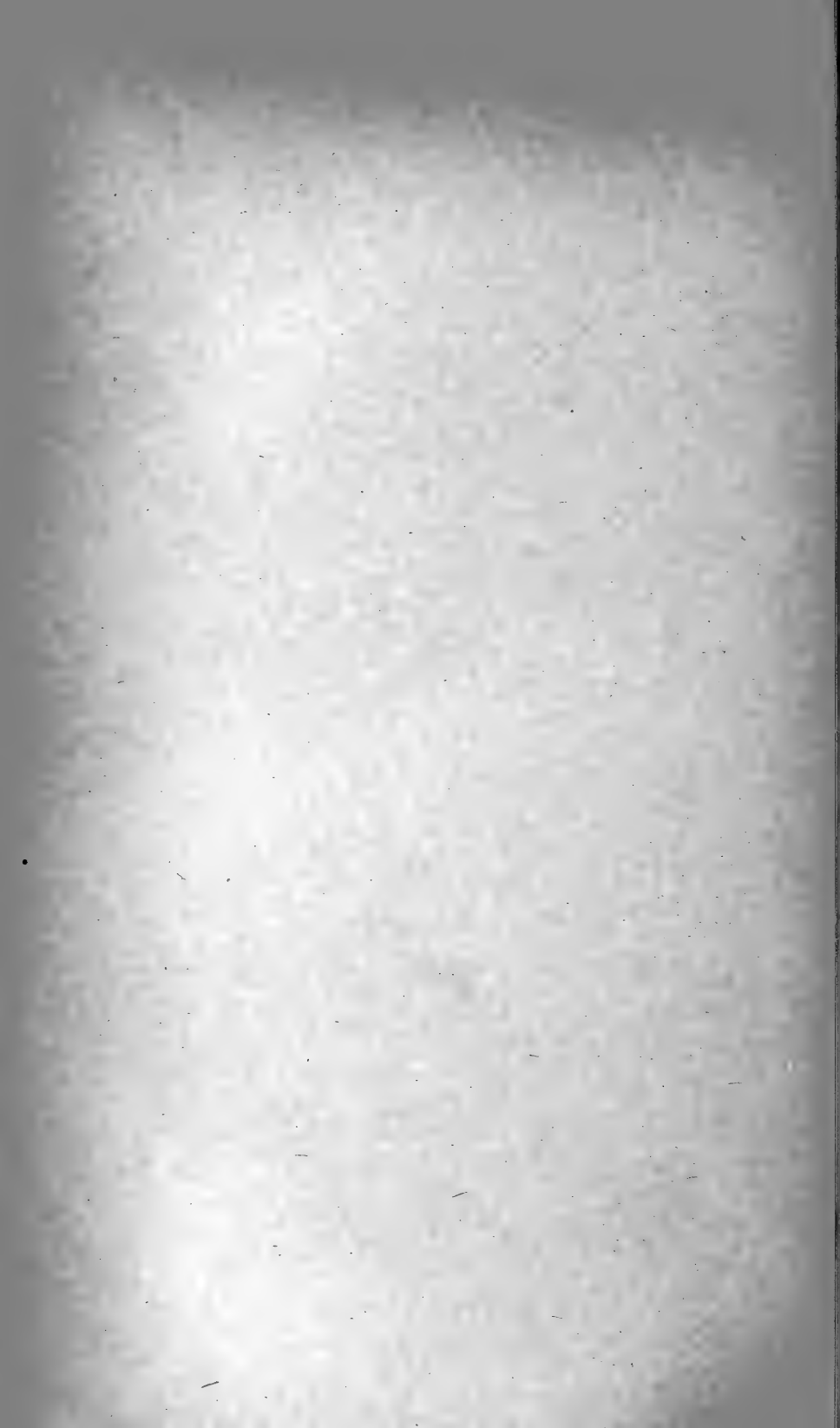
Grinder Run No. 15.

1. *Mytilus* *edulis* *L.*

2. *Mytilus* *edulis* *L.*

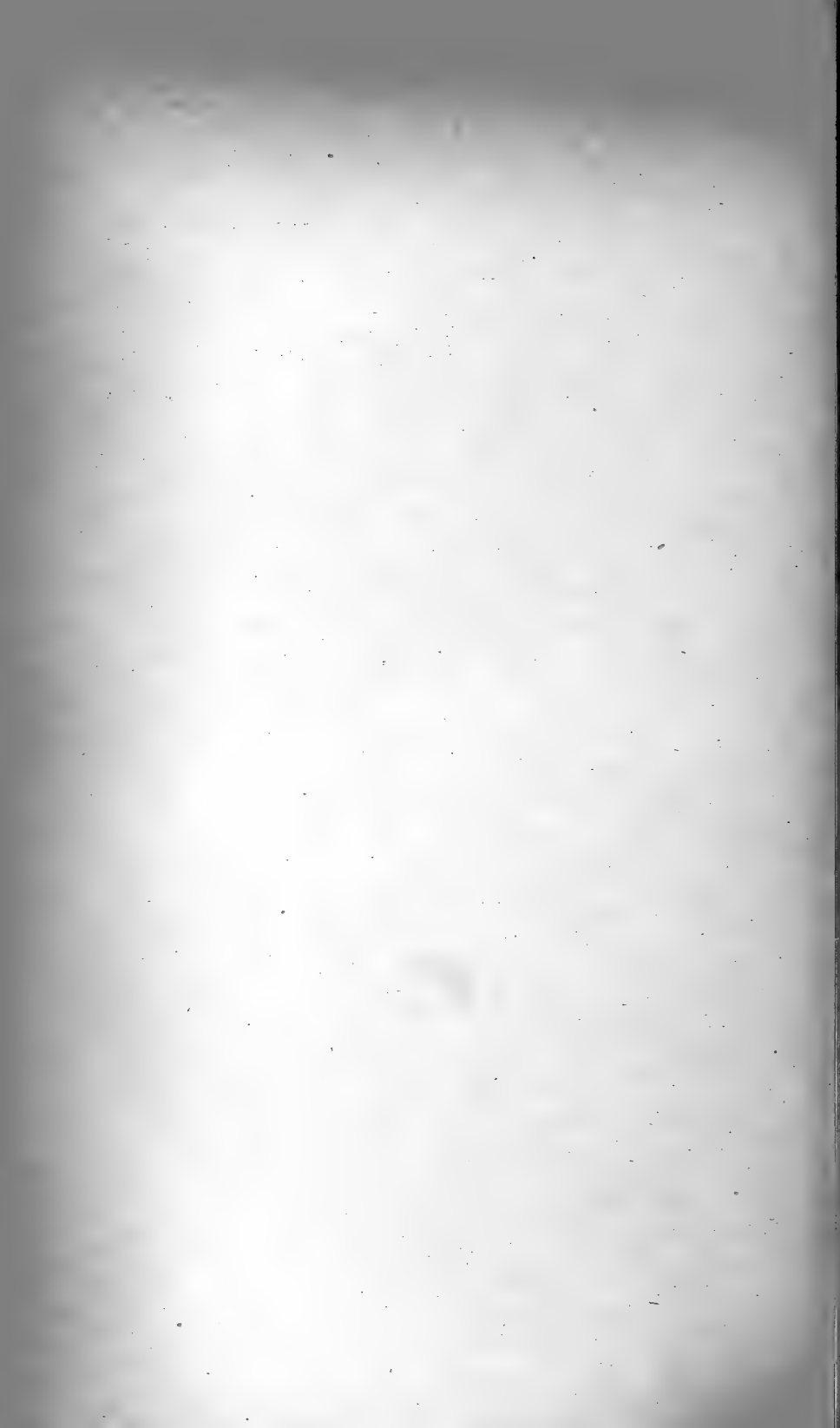
Jack Pine.

Grinder Run No. 27.



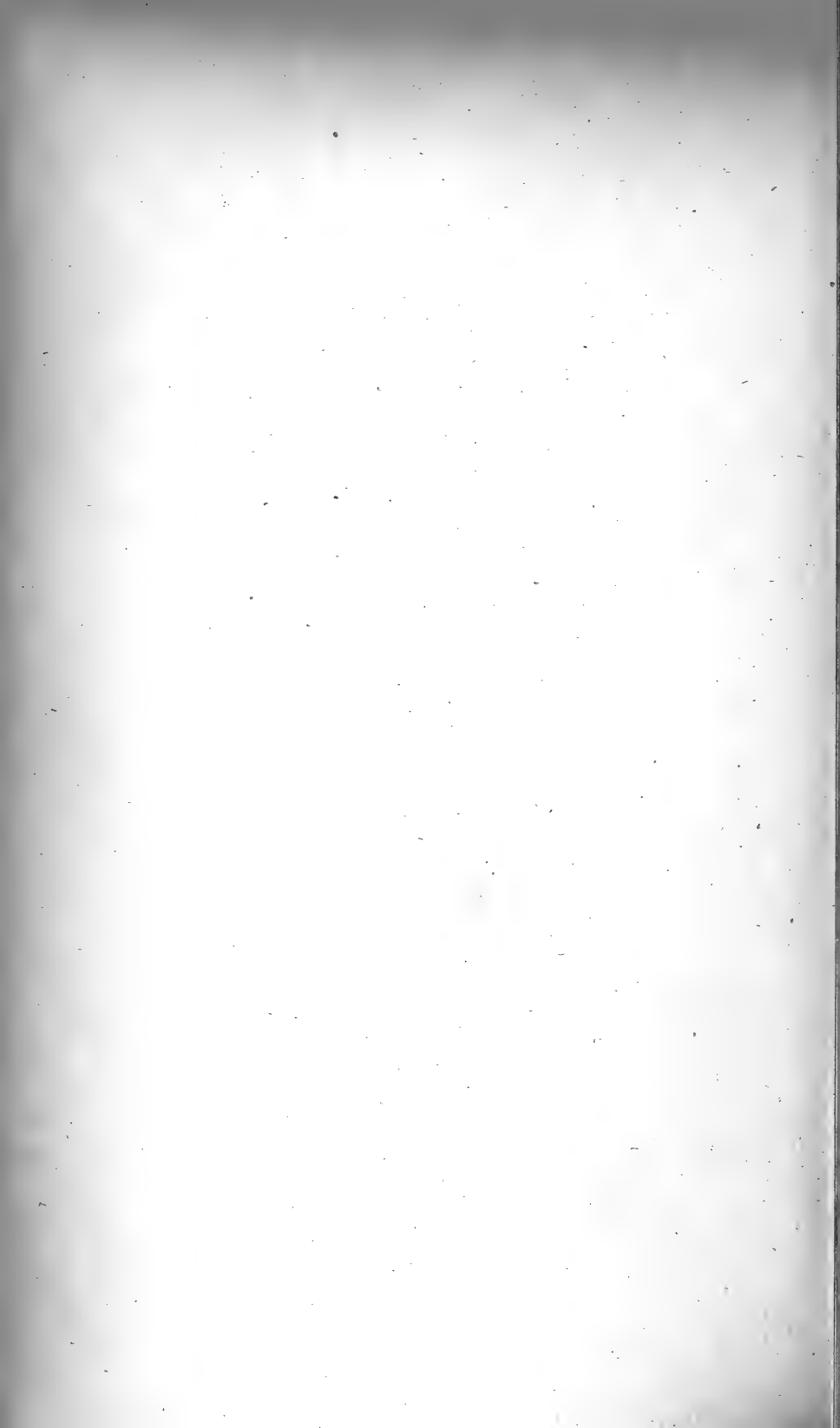
White Pine.

Grinder Run No. 8.



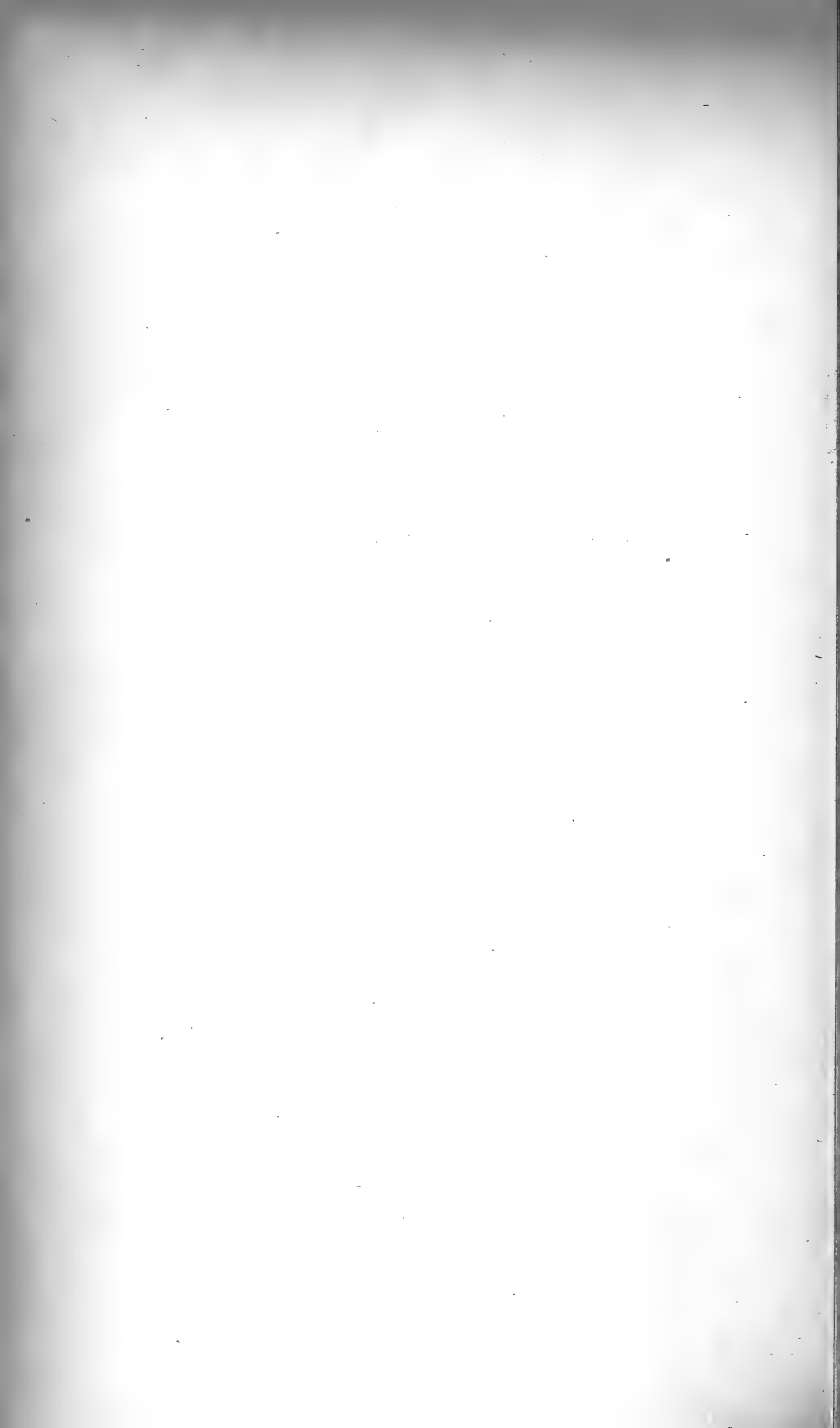
Aspen.

Grinder Run No. 2.



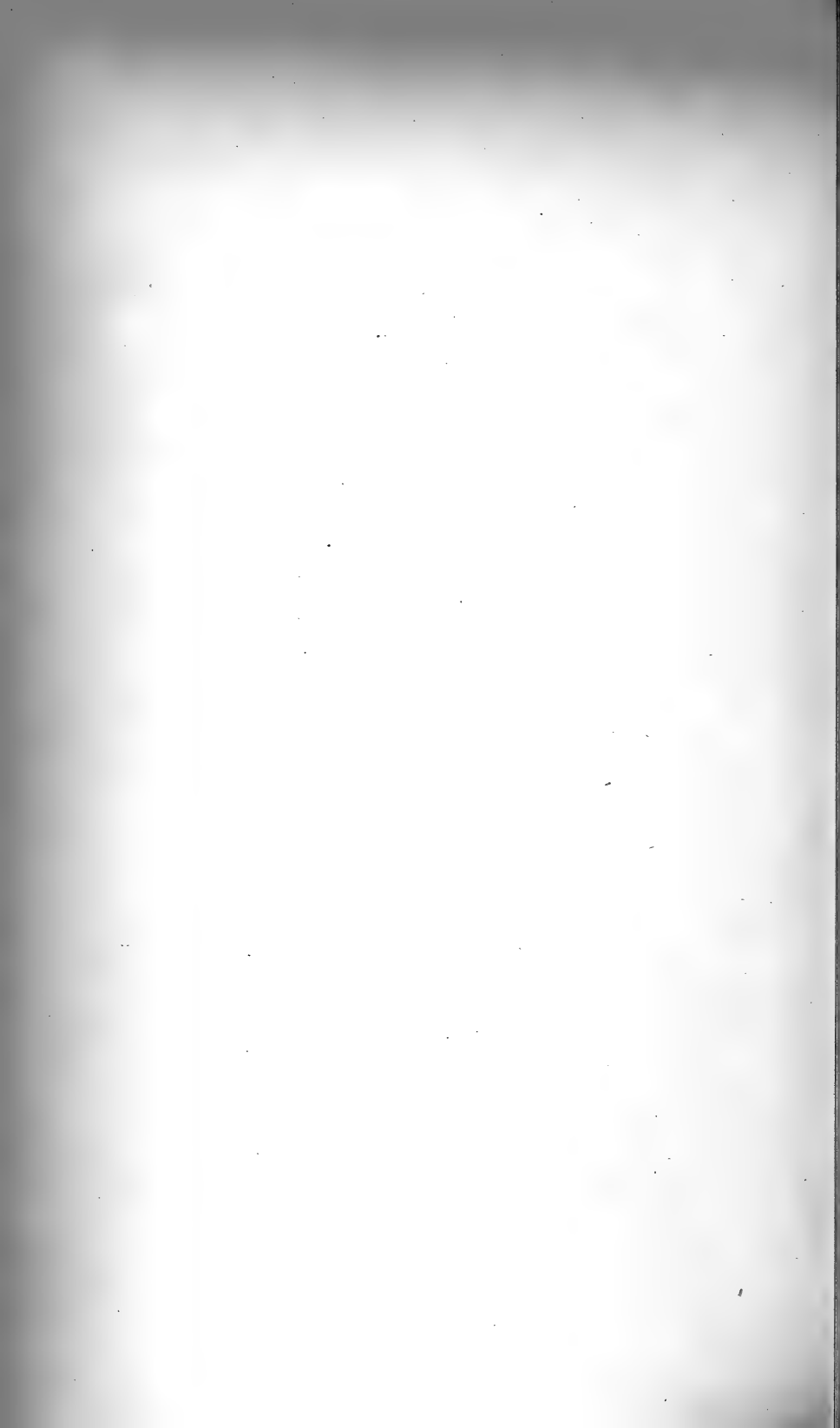
Birch.

Grinder Run No. 9.



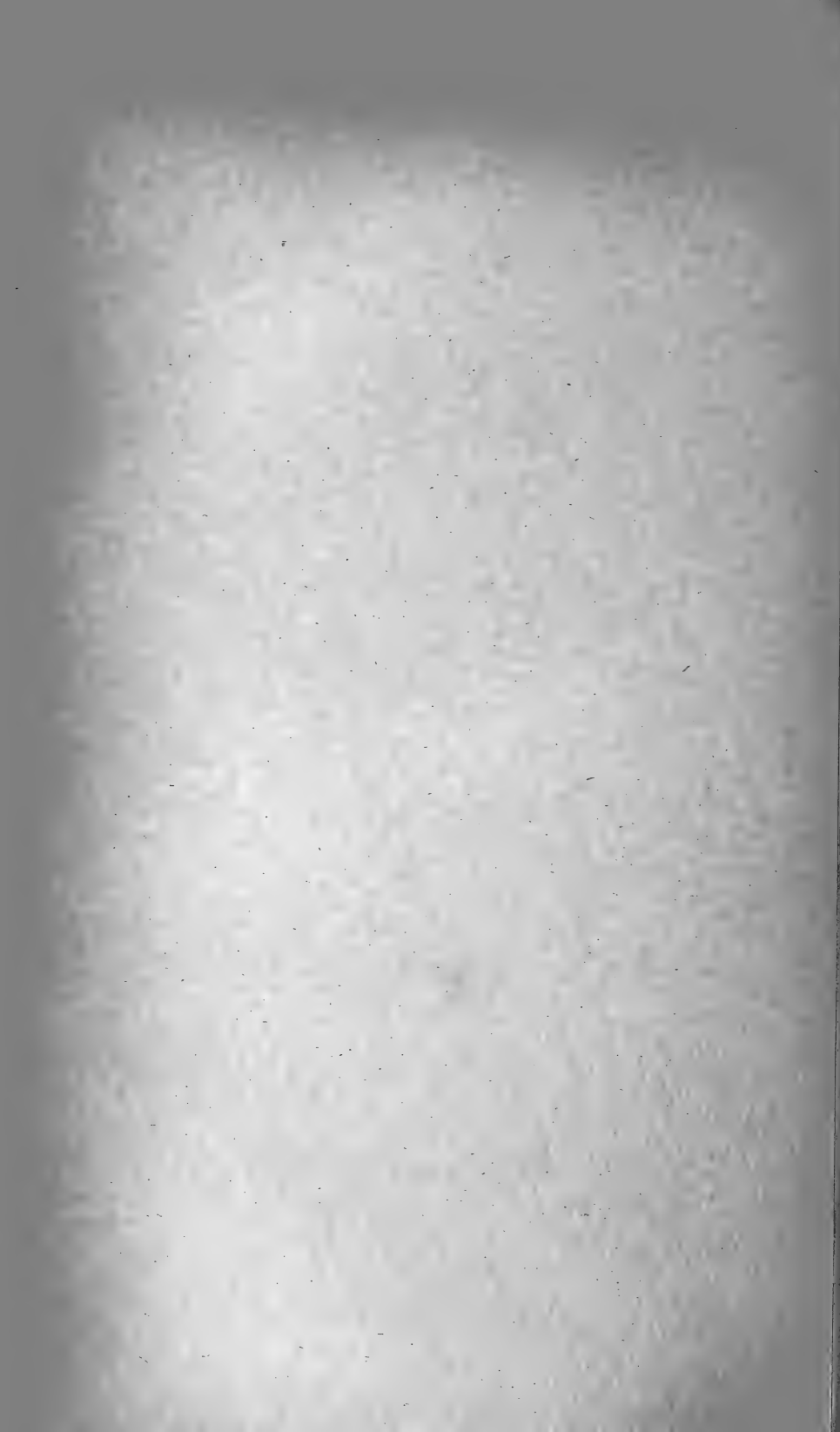
Black Gum.

Grinder Run No. 3.



Loblolly Pine --- fall cut.

Grinder Run No. 6.



Loblolly Pine --- Spring Cut.

Grinder Run No. 28.



Lowland Fir.

Grinder Run No. 13.



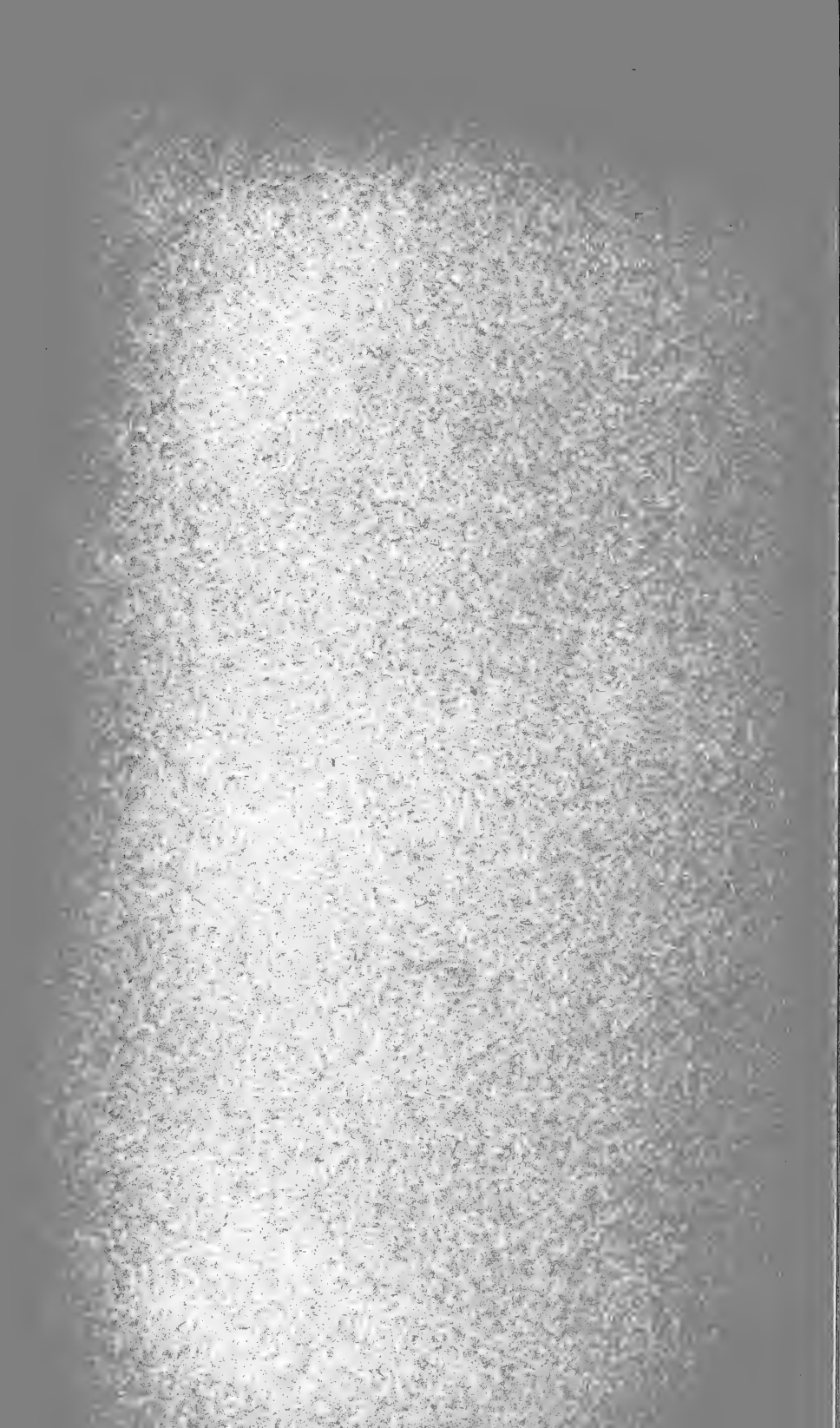
Engelmann Spruce --- Montana.

Grinder Run No. 16.



Western Larch.

Grinder Run No. 8.



Stock No. 1.

White Spruce.

Stock No.

White Spruce

AND OTHER SP

S—HARRY SALLEE PICKLES THE **Stock No. 1** HUGGINS' MEN L



Vin Three Out of Four From Reds Tinker's Men on Their Heads After First bard Three Cincinnati Twirlers

looking for right off the reel. "Reb" Oakes punched a single to center, scoring Mowrey and Sheekard. Marsans tossed the ball home and Oakes grabbed second. Gee, how those Red outfielders love to zing the ball around! O'Leary walked. Joe Tinker danced the high-land fling in the middle of the diamond.

"You're wilder than Powell," shouted "Tink" to his pitcher. "Don't bawl me out, that's something I can't stand," replied Works.

"Well, if I can't bowl you out, I

fundo voice back of the Reds' bench.

"I'd like to climb into the stand and choke you to death," said "Tink."

"Gee, but you're a nice, mild, gentle sort of an animal," said the bass drummer as he fled to a safer spot.

Harry Sallee spanked the leather savagely all afternoon. Harry and "Tink" led their respective teams with the big stick. "Tink" got three rousing wallops and the "Higginsport Huckleberry" also hit the center of the bull's-eye three times.

"Sal" started the

FEV

Kilbar B

LOS though fight i feather Vernon limit o virtual

Carnegie Is Coming Here For Peace Talk Thursday; College Contest To-Night

Other Distinguished Guests Arriving—Lineal Descendant to Unveiling Jefferson Statue.

Distinguished guests who will participate in the dedication of the Jefferson Memorial building, the unveiling of the Jefferson statue and the deliberations of the Fourth American Peace Congress already are arriving in St. Louis.

Andrew Carnegie, who will deliver an address Thursday afternoon at the session of the Peace Congress, is expected to reach St. Louis to-morrow afternoon or Thursday morning. He will be accompanied by Mrs. Carnegie. They will be the guests while in St. Louis of Robert S. Brookings at his home on Lindell boulevard.

Miss Natalie Norton of Elsberry, Mo., a lineal descendant of Thomas Jefferson, was chosen yesterday to unveil the Jefferson statue. Miss Norton is the daughter of Porter Norton of Elsberry.

The first of the Peace Congress ceremonies, which will continue throughout the week, will be to-night in the Sheldon Memorial Auditorium. This is the Missouri oratorical contest of the Intercollegiate Peace Association.

Former Judge Selden P. Spencer will preside. A student from each of six Missouri colleges will compete. The first prize of \$75 is offered by the Intercollegiate Peace Association, and the second prize of \$50 is offered by the American Peace Congress.

Tierney St. Louis U. Orator.

Central College, at Fayette, will be represented by Edward Verson Nash, who will speak on "Our Relation to Peace." John Leo Tierney of St. Louis University will speak on "International Peace." George C. Wilson of the University of Missouri will speak on "They, Too, Are Brothers."

Washington University will be represented by R. J. Puchschmidt, whose oration is entitled "The Justice and Honor of Nations." Westminster College, at Fulton, is represented by Sidna Poage Dalton. His subject is "The Demand for International Peace." William Jewell College, at Liberty, will be represented by Frank R. Birkhead, who will have for his subject "War, the Sum Total of Wretchedness."

More than 1,000 delegates from all sections of the country and many distinguished persons from abroad will at-



MRS. D. A. McDOUGAL.



MRS. MARGARET J. MONROE.



MRS. ARTHUR H. GEISLER.



MRS. CLAUDIA HAZEN WHITE.

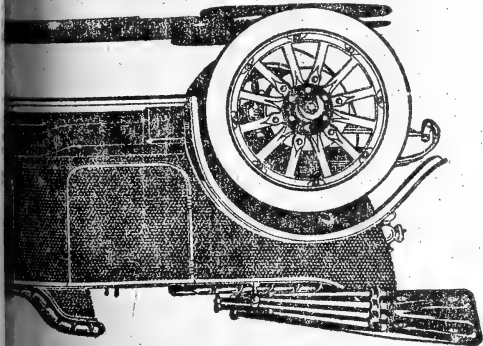
MISS ANNA

Stock No. 2.

Western Hemlock.

Chalmers

Made in China



1913 Model 17-5-Passenger

The Smallest

Accurate fit is the most essential feature of a motor vehicle.

The smallest thing you ever saw is a ponderous mass when compared with the variation allowed in some of the parts which go into Chalmers cars.

One one-thousandth part of an inch is the allowance on most of the working parts. One-half of 1-1000th part of an inch is the allowance on gears.

Can you imagine one-half of 1-1000th of an inch? Take your desk ruler and figure it out. Divide the little 1-16-inch space into 128 parts. That is how accurately Chalmers gears are ground. To measure such infinitesimal spaces Chalmers workmen use gauges of wondrous accuracy. Steel gauges so fine that they can detect the expansion of a thick bar of steel from the heat of a man's hand. "Micrometers" capable of measuring as fine as one ten-thousandth of an inch.

Pistons, cam shafts, connecting rod bearings, wrist pins, gears—all working parts are gauged with almost precision. Thus accurate fit is

Dark Automobile

5201-03 Delmar

CHEMICAL CONCERN

LOSES ITS CHARTER

U. S. R.

MR. BELL DENIES

HE FAVORS CARTER

That He Is Not Now Available to Head National Bank of Commerce.

NAME PRESIDENT TO-DAY

dolph, Acting Chief, Remains Most Likely Candidate for

Vacancy.

The National Bank of Commerce directors to-day will have their first meeting since the special session of Thursday, when the resignation of Mr. Edwards from the presidency of the institution was announced. It is within the power of the board to fill the vacancy at this meeting by naming a successor to Mr. Edwards. Some believe that while the matter will be up for discussion, no action will be taken, and some predict the new active will not be chosen until next month.

in Randolph, vice president of the commerce, and who is serving as president, apparently remains the likely possibility of those who have mentioned in connection with the reports persistently circulated that Mr. Campbelle, leading director of Mercantile Trust Company and a former director, favored W. Frank Carter for the place yesterday, were ascertained by Mr. Campbelle to be without foundation.

Western Hemlock.

Article Absolutely Unavailable. That article is absolutely unavailable, said Mr. Campbelle when a post-assertion in an afternoon paper. Carter was slated to be head of Louisville's largest bank was shown him. Carter now is vice president of the Louisville Trust Company.

Stock No. 2

Delmar 1100

FOR JOBS
ALL TO-DAY

Great Clash
and Gordon
ner's Scalp.

Is in Line
at Arms to
Wray.

the City Council
to effect its per-

retary to Janitor,
to assistant sec-
led out by the

original Kiel man
id, assistant sec-
is the stumbling

credit for rout-
when Commi-
took to deliver

Gordon off its
request of Com-
the unpleasant for

will be on this
take the place for
is scheduled, and

will favor such a
Gordon's friends,
for will use their

ordon indorsed for
sergeant-at-arms,
the fact that he is

CLEAR

of all that's left from
this week, many lines
many lines at a fra

About

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Ha

Silk

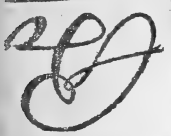
50c SIL

SILK

at

Hand

40%



\$2.50 Imported Madras

SHIRTS

Go at 95c

\$1.50 Negligee and Pleated

SHIRTS

Go at 75c

\$3.00 and 3.50 Soft Felt

HATS

at 95c Each

75c qualities of

SHIRTS and DRAWERS

All styles and sizes,

at 45c

ALL

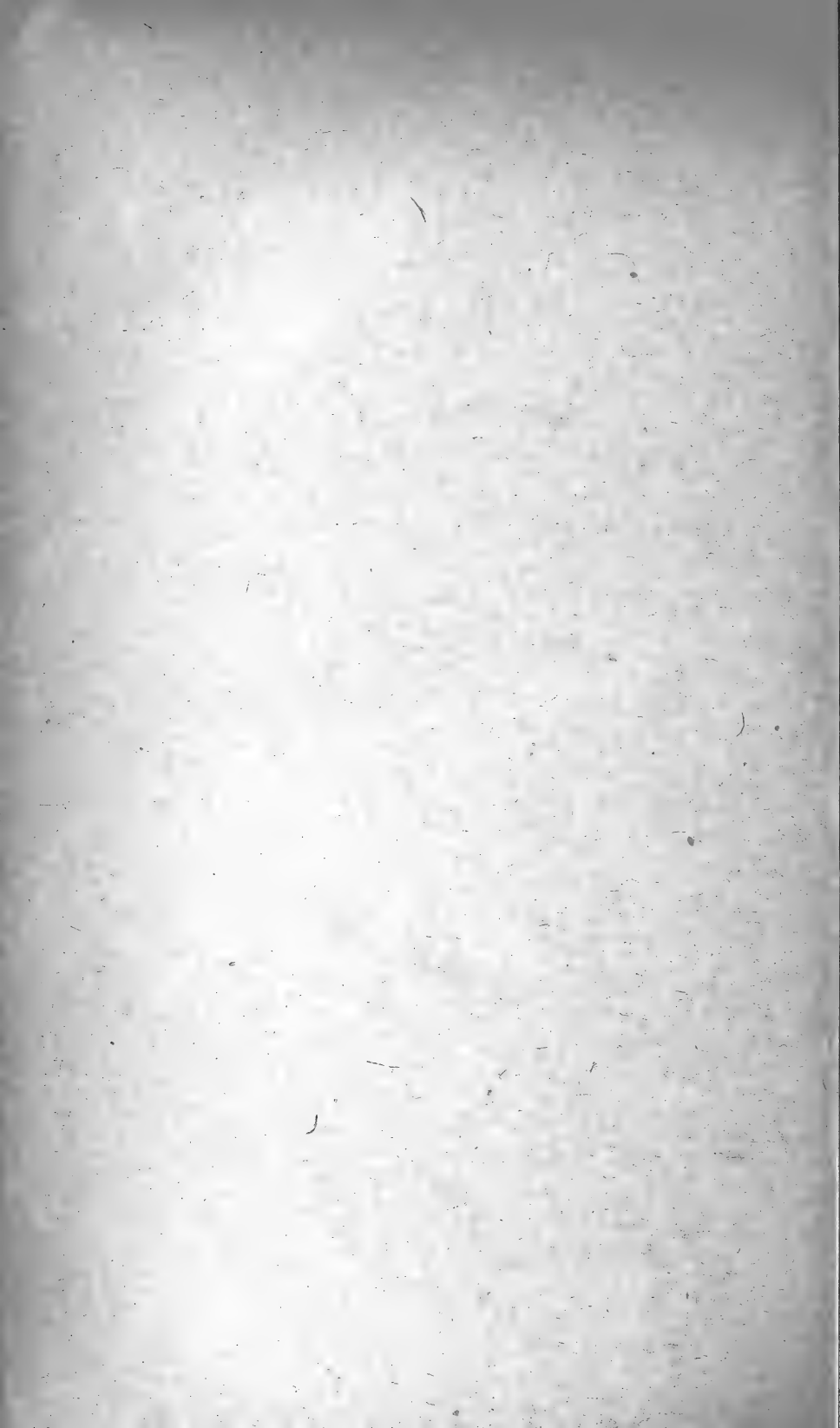
White Shirts

30% OFF

"Where
Quality is

Stock No. 3.

Sitka Spruce.



RECORD OF BIRTHS

Boys.

and A. Alles, 5609 Michigan.
and S. Bahr, 8424 Pennsylvania.
and L. Lewis, 3021 Rauschenbach.
and M. Juch, 4431 Penrose.
and C. Knaus, 443 Wilmington.
and D. Jaffke, 4633 S. Grand.
and A. Leisinger, 4327 A. Clayton.
and A. O'Connell, 5219 Theodosia.
and A. Langer, 4205 Warne.
and E. Evans, 1806 Nebraska.
and A. Schutt, 2352 Arkansas.
and M. Seville, 1842 S. Fourteenth.
and M. Fischer, 4558 N. Broadway.
and M. Murray, 8501 Grace.
and C. Weh, 1418 N. Ninth.
and K. Schuermann, 2906 Palm.
and M. Rogers, 4207 Fair.
and N. Etz, 2804 Market.

Girls.

and I. Hanneck, 2629 Gravoia.
and H. Hoffman, 2314 La Salle.
and A. Vogel, 3634 Tholozan.
and M. Mowrey, 2903 Sullivan.
and L. Hisselberger, 4361 E. Broadway.
and M. Weston, 4318 Washington.
and B. Stevens, 1016 S. Eighth.
and A. Spencer, 6214 Washington.
and B. Odenwalder, 2609 S. Eighteenth.
and A. Zibb, 1040 Emmet.
and A. Mundweller, 2018 Menard.

MARRIAGE LICENSES

Sold Gold Wedding Rings, \$3 to \$25.
JACCARD'S, Broadway, cor. Locust.

| | |
|--------------------------|----------------------|
| Wenzel Alford Gales | 2645 Pine |
| Amie Snapps | 2645 Pine |
| Carl Ullman | 6276 Wilson |
| Amel Vosburg | 1916 Knox |
| Robert Cox | 8513 Bell |
| Amel Frederick | 2735 Wyoming |
| Marcus Roscoe Cutler | Moweaqua, Ill. |
| George Gilliland | Moweaqua, Ill. |
| George H. Bliss | Chicago, Ill. |
| Will M. Stanton | 2810 Eads |
| John Lehen | 721 Lami |
| Juline Schwaib | East St. Louis, Ill. |
| Al Lillard | Natchez, Miss. |
| Mary Griffin | Natchez, Miss. |
| Charles J. Lusch | 2639 January |
| Edith Wood | Alton, Ill. |
| Edwin E. R. Schellenberg | 1523 S. Seventh |
| Emma Lehrmann | 1523 S. Seventh |
| Joseph D. Veatch | 5567 Von Versen |
| Eden S. Butler | 6039 Suburban |
| Walter Seim | 3722 Texas |
| Willie O'Connell | 4468 McPherson |
| Charles Ketchum | Taylorville, Ill. |
| Alinda Durbin | Taylorville, Ill. |
| Henry Spies | Donaldson, Ill. |
| Emma Umphres | Donaldson, Ill. |
| Port Louis Huber | 4817 Goethe |
| Christine Gronewald | 5737 Kennerly |
| Philip Trost | 2911 Arsenal |
| Antonia Bratoz | 2911 Arsenal |
| Peter Carpiw | 153 St. George |
| Katharina Slipec | 156 St. George |
| August H. Hofeldt | Chicago, Ill. |
| Lyla B. Haskell | Maplewood, Mo. |
| Ralph E. McAninch | Cleveland, Mo. |
| Edna M. Swain | Kinmundy Hill |
| Robert P. Strellinger | Detroit, Mich. |
| Arguerite D. Stevenson | 4622 Westminster |
| Wesley Sawcuj | 1428 N. Ninth |
| Leonora Stolarczyk | 1425 N. Ninth |
| Edison H. Brown | 3012 Clark |
| Wm. Cora A. Bohn | 4224 Papin |
| Arthur R. Clarkson | 1525 Marcus |
| Louise Schuermann | 1811 N. Leffingwell |
| Clarence D. Asbury | Dallas, Tex. |
| Mrs. Marie K. Kelly | 3955 Ashland |
| Otto G. Goertz | 2327 Rauschenbach |
| Elizabeth Kutz | 1308 North Market |
| Tom Quacatto | Panama, Ill. |
| Elizabetha Battu | Panama, Ill. |
| Clarence Wobbe | 2012 N. Nineteenth |
| Irene Ottensmeyer | 1444 Dodier |
| Henry Zurmuehler | 4400 Vista |
| Gusta Schwarz | Tipton, Mo. |
| Frank L. Bartlett | Gricksville, Ill. |
| Lena L. Wilkinson | 2704 Geyer |
| Constans Olzevski | 1407 N. Ninth |
| Rozalia Rogavska | 1420 N. Ninth |
| Dee Roy Simons | Madison, Ill. |

MARRIAGE AND DEATH NOTICES.

Marriage and Death Notices inserted in The Republic will be forwarded by telegraph to any one or all of the morning papers named below for simultaneous publication, without extra charge, if a request to do so accompanies the copy. Notices received after midnight cannot be forwarded, however, until the next evening: Syracuse-Post-Standard, Providence Journal, Chicago Record-Herald, Pittsburgh Dispatch, Cleveland Plain Dealer, Cincinnati Post, St. Paul Pioneer-Press, St. Louis Post-Dispatch, Minneapolis Tribune, Buffalo Courier, Cincinnati Enquirer, New York Times, Philadelphia Public Ledger, Boston Globe.

PEETZ BROS.

NEW FUNERAL CHAPEL.
NOW LOCATED AT 2739 LAFAYETTE ST.
UNEXCELLED SERVICE.

HENRY LEIDNER,

Undertaker's Parlor for Services FREE.
2223 St. Louis Avenue.
Tyler 517. Central 1708.

ELMER SHEPARD,

UNDERTAKER, 5921 EASTON AV.
Cabany 3797, Lady Assistant, Delmar 2148.

ALBERT HARRAL,

FUNERAL CHAPEL, 2320 UNION BL.
DELMAR 211. FOREST 4784.

VALHALLA CEMETERY

Highest beauty—perpetual care. Grounds on St. Charles Rock road, one mile west of Wellston. Olive 4480; Central 2496.

Alexander, the Undertaker

Motor service Funeral parlors.
Receives, Forwards, Interers.
Boromet 461. 2833 Olive. Central 4169.

DEATHS.

HARRISON—Entered into rest on Monday, April 28, 1913, William I. Harrison, aged 55 years.

Funeral from George N. Lynch's undertaking parlors, 2229 Olive street, at 1 p. m., April 29. Interment private.

KUHN—Entered into rest, suddenly, on Sunday, April 27, 1913, at 10 o'clock p. m., Lucy Kuhn, beloved daughter of Emil and Emma Kuhn, sister of Olga and Ferdinand Kuhn, aged 19 years 4 months and 6 days.

Funeral will take place from the family residence, 2462 Plover avenue, on Wednesday, April 30, at 9:30 o'clock a. m., to Church of the Nativity (Walnut Park), thence to Calvary Cemetery. Friends are respectfully invited.

MILLER—Entered into rest on Monday, April 28, 1913, at 4:25 p. m., Christine Miller (nee Laubach), dear mother of Christine Sutton (nee Miller), Kate Stelzer (nee Miller), Louisa Bohley (nee Miller), Theophilus Miller and Emil Miller, and our dear sister, sister-in-law, mother-in-law and grandmother, at the age of 62 years.

Funeral Wednesday, April 30, at 2 p. m., from residence, 3340A Ohio avenue, to SS. Peter and Paul Cemetery. Interment private.

MITCHELL—Entered into rest, Monday, April 28, 1913, at 6:30 a. m., after a lingering illness, William P. Mitchell, beloved son of Mrs. Susan Mitchell Mott (nee Robbins) and the late John Mitchell, and dear brother of Mrs. J. E. Barclay, John, Frank, Clarence, Irene, Helen, Loretto, Michael and Joseph Mitchell.

Funeral will take place from residence, 314 Chouteau avenue, Wednesday, April 30, at 8:30 a. m., to Immaculate Conception Church, thence to Calvary Cemetery. Friends of family invited to attend.

Deceased was a member of Peace Lodge, No. 108, B. of L. F. and E.

POHLE—Entered into rest Saturday, April 26, 1913, at 11 p. m., Julius Pohle, dearly beloved husband of Margarette Pohle (nee Fishback), dear father of William, Harry, Gertrude and Violet Pohle, our dear brother.

BUSI

If you have the 14c solid gold mou terms, Loftis Bros.

SITUATIONS

CASHER—Ex out of town, desir of May; can write respectable. Address Mo.

COOK—Situati good references.

DRESSMAKER fancy gowns, Phone Sidney 32.

FANCY gowns excellent dressm lent fitting. Side

HOUSEGIRL—work, 2621A Ead

HOUSEWOMAN woman for house K 62, Republic.

LAUNDRESS—colored laundres days, Phone Bo

LAUNDRESS—last 4 days of Olive 3153.

LAUNDRESS—waists 15c, city Central 9737L

LAUNDRESS—take home, se washington, Bon

NURSE—Situat price reasonable.

NURSE—Situat dress F 68. Repi

Stove

A. G. BRAUER

HELP W

HOUSEGIRL—5087 Cates.

HOUSEGIRL—4263 West Pine.

HOUSEGIRL—Illy, 4128 West

HOUSEGIRL—family 3 grown Minerva.

HOUSEGIRL—housework; no good wages. 46

HOUSEGIRL—2 in family. Ap ster Groves, to

HOUSEGIRL—work; must hav wages \$25 a m Versen av., or t

MAID—White and cooking; fair Telephone Caba

COOK—Compe 4359 Lindell.

COOK—German rant; no Sunda

GIRL to cook \$5 weekly, Cal Westminster.

STENOGRAPHER

EXPERIENCE copyist; \$10 Le

STENOGRAPHER lady stenograph bookkeeping; m bldg.

GIRL, experi mining ladies' Mfg. Co., 1105

NCED T TRADE

FAIR ADVANCE IN WHEAT AND CORN

MANY ISSUES SET ON EUROPEAN F

Havoc Played With Berlin, Paris
Reflected in Disturbance at
Tendency After First Half

Bugs and Dis-
Abroad Fa-
s.

Crop News Favorable, but Statis-
tics Help Buying Side—
Oats Unchanged.

April 28.—Export
red wheat European
net upturn of 1/2¢
net rise of 1/2¢ @
2 1/2¢ to 17 1/2¢
00 bu. of hard
50,000 bu. in the
at a rally after
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mission house
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res.
Closing Prices.
April 28.

| | | |
|----------|--------|----------|
| 92 1/2 b | 92 | 92 1/2 b |
| 92 1/2 b | 91 1/2 | 91 1/2 b |
| 92 1/2 b | 91 1/2 | 91 1/2 b |
| 92 1/2 b | 54 1/2 | 55 1/2 s |
| 92 1/2 b | 55 1/2 | 55 1/2 s |
| 92 1/2 b | 55 1/2 | 55 1/2 s |
| 34 1/2 b | 24 1/2 | 24 1/2 b |
| 34 1/2 b | 24 1/2 | 24 1/2 b |
| 45 | 19.63 | |
| 50 1/2 | 19.67 | |
| 50 1/2 | 19.47 | |
| 55 s | 10.90 | |
| 80 s | 10.82 | b |
| 77 1/2 b | 10.85 | b |
| 22 s | 11.30 | |
| 30 s | 10.95 | b |
| 72 1/2 | 10.77 | 30 |

depressed proce-
s sharply be-
s.

arkets.

Closing Prices.
April 28.

| | | |
|--------|----------|----------|
| 105 s | 93 1/2 | 93 1/2 s |
| 96 | 1.66 1/2 | |
| 94 | 1.63 1/2 | |
| 93 1/2 | 93 1/2 | |

ST. LOUIS FUTURE PRICES.

| | Closed Saturday. | Ranged Yesterday. | Closed Yesterday. |
|------------------------|-----------------------|----------------------|----------------------|
| Wheat— | | | |
| May....92 1/2 @ 1/2 a | 92 1/2 @ 92 1/2 @ 1/2 | 92 1/2 @ 1/2 a | |
| July....89 1/2 a | 89 1/2 @ 90 1/4 | 90 1/4 b | |
| Sept....89 1/2 | 89 1/2 @ 90 1/4 | 90 1/4 b | |
| Corn— | | | |
| May....54 1/2 a | 54 1/2 @ 55 1/2 | 55 b | |
| July....55 1/2 | 55 1/2 @ 55 1/2 | 55 1/2 a | |
| Sept....55 1/2 a | 55 1/2 @ 55 1/2 | 55 b | |
| Oats— | | | |
| May....33 1/2 a | 33 1/2 @ 33 1/2 | 33 1/2 b | |
| July....33 1/2 @ 1/2 a | 33 1/2 @ 33 1/2 | 33 1/2 b | |
| Sept....33 1/2 a | 33 1/2 @ 33 1/2 | 34 1/2 a | |

Cables were irregular, but Liverpool closed higher on a less favorable European political outlook and largely on the strength of this wheat was on the upturn in the local market. News in this country was mainly favorable, both in the winter and spring belts, but there were decided signs of manipulation by the bull crowd at Chicago and little attention was paid to anything but the Chicago blackboard.

There were reported sales for export at the various domestic centers, but nothing startling and primary receipts for the day were enormous, 1,369,000 bu., comparing with only 530,000 bu. a year ago. Statistics showed up mildly bullishly, but the decrease in the domestic visible was not large for this season and weather in all directions was all that could be desired.

May wheat, which opened a split higher at 92 1/2¢, sold up to 92 1/2¢ @ 1/2¢, where it closed, thus recording an advance for the day of 1/2¢. The more distant deliveries were correspondingly firm and on the upturn, July wheat ranging from 89 1/2¢ to 90 1/4¢ and closing 1/2¢ higher at 90 1/4¢, and the Sept. delivery closing 1/2¢ @ 1/2¢ higher at 90 1/4¢ bid.

Strength extended as well to the market for cash wheat. Offerings were liberal, 19 cars of soft winter and 49 cars of hard winter, but there was a brisk demand and prices were higher, especially on hard winter, which was taken by local and outside mills, mainly the latter, at an advance of 1/2¢ to 1¢. Several cars of soft winter were offered and selections sold at \$1.12 to \$1.12 1/4. Southern Illinois mills picked up the choice.

Elsewhere the cash demand was good. Minneapolis reported an active cash market, with Chicago houses the best buyers, and No. 1 Northern selling at a premium of 2 1/2¢ over May. The flour demand was better. Kansas City and Chicago reported good buying, with the latter city claiming some goodly sales for export. Winnipeg wired that the cash demand there was better.

Minneapolis stocks decreased 175,000 bu. for two days this week and a wire from that point said that seeding is

NEW YORK, April 28.—Austria's generally delicate political situation in Austria, Berlin, Paris and London to this condition was reflected in no market and resulted in a new level issues. The copper shares were the Copper losing 1 1/2 points on the very

The first half hour, however, saw remaining after last week's persist rest of the day the tendency was to

Prices, to be sure, did not rally particularly hopeful sign that on the trading grew very dull. Nevertheless movement plainly had run its course

The pressure against the investment of the class of Northwestern, Greatly firm.

New York Central rallied well in Lake Shore notes had been sold in London obligations put out by the Vande

ABSENCE OF LIQUIDATION

There were fairly reassuring symptoms of further liquidation in the bond market like the Erie convertibles, the Interborough Railways 5s were noticeably weak, but higher rank were done at the improve

Had it not been for the fear of the our market probably would have had tions toward the end of the session. play of weakness on the foreign stock developments have become of great corporate borrowing has begun to

Several of the tobacco stocks from the high of the year, American Lorillard and G. W. Helme show American Tobacco this afternoon rallied

RESISTANCE OF STEEL

The resistance of Steel to professional points of the market for the last small. This morning it broke below out under that figure. It is no doubt outlook for a very favorable March mates from Pittsburgh of the net ear would be a new high record for the

The general feeling is, however, \$38,000,000.

The \$50,000,000 railroad investment proving to be a big toy for the Rebels miles of the line are being operated. President Randolph wanted to make fare.

The Rebels have free week-end joy, all the population of the towns get the road as fast as they can go. So the first time since 1908.

firm. Sales: 350 sks. hard clear to arrive at \$3.85; tube, 155 hbls. soft patent (direct order by local mill) at \$5.75 wood, 2 cars do- grades at \$2.60 to \$2.90. Hard—Patents \$4.15 @ \$4.25; straights \$3.90 to \$4.10; first clear \$3.15 to \$3.80; second clears at \$2.85 to \$3.10; and \$2.50 to \$2.75.

Quote in Jute sks.: Soft—Patents at \$4.45 @ 4.75; straights at \$4.25 @ 4.45; extra fancy at \$3.70 to \$3.85; fancy at \$3.15 to \$3.80; low grades at \$2.60 to \$2.90. Hard—Patents \$4.15 @ 4.25; straights \$3.90 to \$4.10; first clear \$3.15 to \$3.80; second clears at \$2.85 to \$3.10; and \$2.50 to \$2.75.

Stock No. 4.

Lodgepole Pine. --- Montana.



Robbed, Thrown from Eads Bridge.
Adam T. Dettling, who says he is an engineer of Bonne Terre, Mo., was found by Patrolman Bronsrahah of the Carr Street Station on the levee last night, with his clothes dripping wet. He said three footpads robbed him of \$4.50 and threw him off Eads Bridge into the Mississippi. He was held at the City Dispensary. Dettling was well clothed and wore a gold watch and a heavy gold ring.

Stock No. 5.

Western Yellow Pine.



...ed to the
rd rumors
utter" in
red he did

...moved to Granite. To-day's witnesses
all commend the management of the
institution.

BOY, 8, FINDS \$3,000 GOLD

Stops Mother About to Throw Treasure in Garbage Can.

DECATUR, Ill., April 28.—Wayne Uhrich, 8-year-old son of Walter Uhrich, a barber, was responsible for the discovery of \$3,000 in gold in two small cans contained in a larger can in the coal shed last week.

The small boy's curiosity alone prevented his mother throwing the can into the garbage heap, and Uhrich when they moved recently would not have abandoned the old trunk containing the cans without looking into it.

His wife advised him to keep it because of sentiment, the trunk belonging to his father, who died in 1907. Yesterday the boy prevailed on his father to open it, and \$5 and \$10 gold pieces were found, neatly wrapped in paper.

PLOT AGAINST KAISER BARED

Berlin Police Warned of Proposed Attempt on Emperor's Life.

BERLIN, April 28.—A warning that an attempt was to be made on the life of Emperor William during his visit to Karlsruhe, Baden, was received yesterday by the police authorities in Berlin, anonymously, from abroad.

They immediately informed the police of Karlsruhe and Frankfurt, and stringent precautions were taken to prevent any outrage.

PIERCE MAKES A DENIAL

Testimony in Hearing Did Not Reflect on Eben Richards.

To the Editor of The Republic.
The statement in issue of April 28, that "Pierce testified son-in-law signed his name without his knowledge," and "Eben Richards, son-in-law of Henry Clay Pierce, signed Mr. Pierce's name without the latter's knowledge or consent as guarantee for loans aggregating \$2,100,000," is absolutely untrue and is cruelly hurtful to Mr. Richards and myself. There is no foundation for your statement in the official notes of my testimony before Commissioner Muench, wherein I stated as follows:

When Mr. Thompson was loaning his securities to Mr. Van Blarcom and I was loaning my securities to Mr. Van Blarcom, and in my absence and at the request of Mr. Van Blarcom, with the full knowledge of all the officers of the National Bank of Commerce, my son-in-law, Mr. Richards, joined in my name with Mr. Van Blarcom in guaranteeing the National Bank of Commerce the purchase of \$1,545,000 Tennessee Central Railroad general mortgage bonds at the end of a year. Under just what circumstances I do not recollect now my guarantee with Mr. Van Blarcom was also given to the Mississippi Valley Trust Company for \$600,000. During the past many years Mr. Rich-

...publican Councilmen, Joseph M. Ebbe-
ling, Otto G. Koenig and Gustav J.
Herrman.

Two of the suits are contests for seats in the House of Delegates from the First and the Seventeenth wards.

Attorneys Moses N. Sale, Jesse McDonald, Les Meriwether and Glendy B. Arnold, for the Democrats, and Selden P. Spencer and George B. Webster, for the Republicans, will hold a conference soon to agree upon the plans for the general recount of the ballots of the

Stock No. 5.

An order directing the Election Commissioners to open the ballot boxes in the Eighth Ward has been issued by Judge George C. Hitchcock of the Circuit Court.

It was based on application of Rudolph Schneider, defeated Republican candidate for the House, who has laid claim to the seat occupied by James F. Ford, Democrat.

BOND ELECTION IN FALL

Free Bridge Committee to Consider Building of Approaches Before Then.

There is little chance that the special free bridge bond election will be held before September. The Election Commissioners have informed Mayor Kiel that the election could not be held until July at least.

The Mayor is opposed to holding the election in midsummer, as many voters will be away on vacations, so the election probably will be postponed until after vacation time.

The Joint Free Bridge Committee of the Municipal Assembly will convene again Thursday afternoon to discuss the advisability of selecting an approach to the bridge before the election.

Roommate Found Dead in Bed.

Oscar P. Hoffman, 36 years old, a hatmaker, was found dead in bed Sunday by his roommate, George H. Parsons, at 3119 Olive street. The physician summoned said death was due to carbolic acid poisoning. An inquest will be held this morning.

Sensenbrenner's S'XTH AND ST. CHARLES WE GIVE EAGLE STAMPS LOW HEEL PUMPS FOR WOMEN



Best gunmetal calf,
tip or plain toe,
turn or welt soles.
Nothing like it in
town for less
than \$3.50.

Charles Dixon, 12 years old, adopted by the Bakers.

"The custody of the boy is sought by his Uncle George J. Dixon, who alleges the Bakers, who are Protestants, failed to raise the boy a Catholic, as they agreed. The case was brought here to reverse an order of Judge Bird that he be turned over to his uncle. The writ was made returnable in thirty days, when the matter will be heard on its merits.

The Court denied the writ of prohibition sought by Jean Lassance of Paris, France, to prevent Judge Hugo Grimm of the St. Louis Circuit Court from entertaining any further an appeal from a decision of the Probate Court of St. Louis in the final distribution of the estate of Peter Petz, deceased.

Lassance was one of the heirs to the estate and objected to this. The estate is inventoried at \$23,719, and Lassance's share under the distribution and will is \$1,310.

Following is a partial list of the motions disposed of and the other proceedings in the court in banc to-day:

Gold Issue Mining and Mineral Company, resp., vs. Pennsylvania Fire Insurance Company of Philadelphia, app.; respondent's motion to transfer to St. Louis Court of Appeals; appellant's suggestion in opposition to motion to transfer; motion overruled.

William P. Houston, resp., vs. Pulitzer Publishing Company, app.; appellant's motion to tax cost of printing abstract of record allowed for \$81.

Floyd D. Jackson, plf., resp., vs. Edward Butler et al., def., app.; defendant appellant's motion to tax cost of printing abstract of record allowed for \$94.50.

State ex rel. Tebbetts, rel., vs. Holtcamp, Judge; relator's motion to amend and affidavit in support; motion to amend sustained.

State ex rel. Circuit Attorney, rel., vs. Joseph A. Wright, resp.; respondent's motion to strike out certain statements from relator's reply; taken with case.

State ex rel. Joseph A. Wright, rel., vs. McQuillin, Judge, resp.; application of Eliza P. O'Hara for leave to file brief; leave granted.

State ex rel. Tebbetts vs. Holtcamp, J.; in the matter of Letitia Todd Breck vs. Rickards et al.; argued and submitted together, with petitioner's reply to return of respondent filed in 17483.

MARRIAGE OF GIRL, 17, VOID

Foster Mother Refuses to Let Young Wife Live with Husband.

The marriage of Cora Berger, 17 years old, and Otto Berger, whom she was persuaded to marry when she was 15 years old, was annulled by Circuit Judge McQuillin yesterday.

A woman in whose bakery the girl was employed induced her to marry Berger, a baker at the place, she stated. The marriage took place at St. Charles. The woman for whom the girl worked accompanied her and Berger.

They returned to St. Louis immediately after the marriage and called at the home of the girl's foster mother, Mrs. Henry Duewel, of 3227 Hickory street. Mrs. Duewel would not let the girl live with Berger.

Robbed, Thrown from Eads Bridge.

Adam J. Dettling, who says he is an engineer of Bonne Terre, Mo., was found by Patrolman Brosnahan of the Carr Street Station on the levee last night, with his clothes dripping wet.

was instructed nearly two weeks ago to convey recognition to the new Republic as soon as those formalities had been complied with.

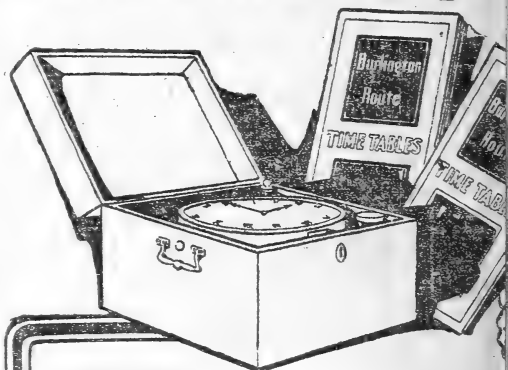
It is said at the State Department, however, that the failure of the Assembly up to this point to choose a Speaker, owing to sharply drawn party issues, is a sufficient obstacle to delay the execution of the instructions.

Notwithstanding the advantage that might be gained by an immediate recognition, it is believed here that the

was under-
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was one of
such action

The bas-
fact that
formed w
extend re
that the
follow tha
nese Gove
ized a co
obtains.

True Timekeeper



Standard Time

The Jeweler's Chronometer and Burlington Time Tables are standards of accurate timekeeping. Watches are set by chronometer. Appointments in on the Burlington Route are made by Burlington time tables and kept by means of Burlington's "On Time" Service.

Hundreds of trains daily maintain Burlington's "On Time" record.

To Kansas City

"On Time"

Go via the Burlington

- and there are many other features.
 - Observation-Club Car; you can eat, smoke.
 - Spacious Smoking Room; private enough.
 - Midnight Train—the famous "Night Hawk."
 - No stop to Kansas City; no confusion, no sleep on the "Night Hawk."
 - Complete dining car service; meals at any hour.
 - Appetizing breakfast—just the kind you'll want.
- "On Time" Every Day is the Burlington

"Night Hawk" leaves St. Louis every night. Arrives Kansas City 7:55 a. m.

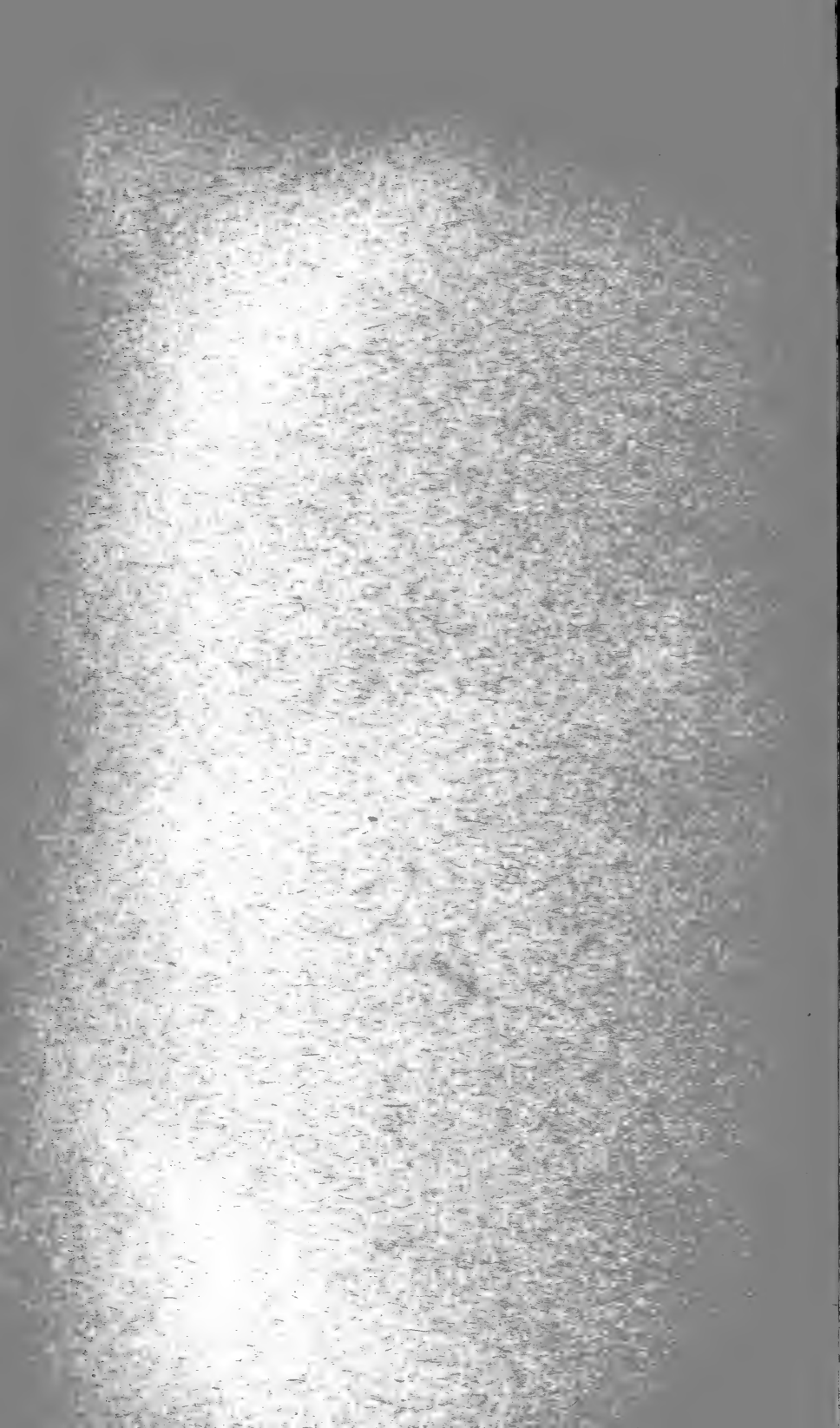


Two other perfect trains leave St. Louis every day. The "Early Bird" leaves at 7:00 p. m.—the "Day Light" leaves at 9:06 a. m.

Just call up—we will

Stock No. 6.

Balsam Fir.



WINTER; CATTLE ARE WEAK

Moderate, but Demand
nap—Native Beeves
15c to 20c.

| RECEIPTS. | |
|-----------|--------|
| ..... | 2,000 |
| ..... | 10,000 |
| ..... | 3,000 |
| ..... | 1,550 |

CATTLE—Beef Steers—An or-
rived, and with quality
Nothing tippy changed
supplies of cattle all
Western markets had
and buyers were out after
market lacked the support
of fair-quality steers went
to in the morning at \$8.05
was about the only steady
in the market. Bulk of the
embracing only the fair to good
ed hands in a range of \$7.25
the amounted to about 10
very trade.

| NO BUTCHER STEERS. | | | | | |
|--------------------|------|--------|------|------|--------|
| No. | Av. | Pr. | No. | Av. | Pr. |
| 22.. | 1358 | \$8.25 | 38.. | 1173 | \$8.05 |
| 19.. | 1054 | 7.25 | 5.. | 716 | 7.15 |
| 8.. | 659 | 6.75 | 3.. | 620 | 6.50 |

ts and Bulls—Not an overly
 arrived and butcher cattle
 steady to strong. The heif
 nothing to brag about, th
 ing the fair to good grades
 steady. Slowness, however
 Very few bunches choic
 and the best price was \$8.25
 from \$7.35 on, those of lesse
 from \$6.75 to 7.25

HEIFERS—Not an overly
arrived and butcher cattle
very steady to strong. The heif-
nothing to brag about, the
ing the fair to good grades,
steady. Slowness, however,
Very few bunches choice
the best price was \$8.25,
from \$7.35@8.25, those of lesser
from \$6.75@7.25.

| HEIFERS. | | | | | |
|----------|-----|--------|------|-----|--------|
| No. | Av. | Pr. | No. | Av. | Pr. |
| 13.. | 738 | \$8.00 | 8.. | 626 | \$7.60 |
| 12.. | 594 | 7.00 | 19.. | 815 | 7.25 |
| 1.. | 660 | 6.25 | 1.. | 580 | 6.00 |
| 1.. | 540 | 5.35 | 14.. | 232 | 4.75 |

| COWS. | | | |
|-------|------|------|-------------|
| 2.. | 1300 | 7.25 | 5..1086 7.0 |
| 1.. | 1080 | 6.50 | 2..1100 6.2 |
| 1.. | 680 | 5.75 | 1.. 910 5.5 |
| 2.. | 660 | 4.75 | 1.. 840 4.2 |
| 1.. | 650 | 3.75 | 2.. 700 3.5 |

| BULLS. | | No. | Av. | Pr. | No. | Av. | Pr. |
|-----------------------------|------|------|-----|-----|-----|------|-----|
| 1.. | 910 | 5.25 | | | 2.. | 1179 | 7.0 |
| 1.. | 1320 | 6.90 | | | 2.. | 1125 | 6.9 |
| 2.. | 1285 | 6.75 | | | 3.. | 1104 | 6.5 |
| 2.. | 1450 | 5.85 | | | 1.. | 1340 | 5.0 |
| Yearlings—A slim showing of | | | | | | | |

Yearlings—A slim showing of
ons on hand. Choice kinds were
would have made change. A
was substituted for the prime
to good grades of veals sold
poorer classes and skim-
at \$8@9, fully steady.

ere scarce, but one or two
ould have made change. A
weights of quality changed
\$7.25@8; heavies, of fair to
sold from \$6.25@7.

| No. | Av. | Pr. | No. | Av. | Pr. |
|-----|-----|-------|-----|-----|-------|
| 5. | 122 | 10.25 | 2. | 125 | 10.00 |
| 6. | 108 | 9.25 | 5. | 138 | 7.00 |
| 42. | 447 | 7.25 | 1. | 330 | 6.50 |
| 1. | 190 | 5.50 | 13. | 317 | 4.10 |

and Feeders—There was a fair demand for calves. Buyers had comparatively easy sale for stock steers sold. Bullock prices low. Choice feeders were scarce. Cows from \$7 to \$7.50. Cows made up for the shortage of calves. Prices ranging from \$3.80 to \$5.60 for yearlings. Hunches for the future.

nd Feeders—There was a fair
nvest had comparatively easy
stock steers sold. Bullocks
day. Choice feeders were scarce
from \$7@7.55. Cows made up a
prices ranging from \$3.80@5.60.

\$7.20@8.90; Texas steers \$6.70@7.75; Western
\$6.90@9.80; stockers and feeders \$6.10@8;
cows and heifers \$3.90@8.25; calves \$6.25@
9.25. Sheep—Receipts 25,000; weak to 15c
lower; native \$6@7.15; Western \$6.25@7.15;
yearlings \$6.50@7.90; lambs, native \$6.60@
8.70; Western \$7@8.75.

KANSAS CITY, Mo., April 28.—Cattle—
Receipts 8,400, including 700 Southern; 10c
to 20c lower; dressed beef and export steers
\$7.90@8.50; fair to good \$7@7.85; Western
steers \$6.75@8.25; stockers and feeders \$6.50
@7.90. Southern steers \$6.25@8. Southern
cows \$4.25@7; native cows \$4.25@7.35; na-
tive heifers \$6.75@8.25; 2 bulls \$5.75@7.25;
calves \$6@9.50. Hogs—Receipts 10,000; 15c
to 25c lower; bulk \$8.25@8.45; heavy \$8.25@
8.40; packers and butchers \$8.20@8.55; light
\$8.35@8.60; pigs \$7.25@8. 12,000; steady to 10c
lower; bulk \$7.50@8.60; yearlings \$6.25@7.00; wean-
ers \$5.50@6.75; ewes \$5@6.50; stockers and feed-
ers \$4@5.50.

ST. JOSEPH, Mo., April 28.—Cattle—Re-
ceipts 1,600; slow; steers \$7.25@8.75; cows
and heifers \$4.25@8.50; calves \$5.50@8.75.
Hogs—Receipts 5,500; 15@20c lower; top
\$8.50; bulk \$8.30@8.40. Sheep—Receipts 7,
000; lower; lambs \$7.50@8.65.

SOUTH OMAHA, Neb., April 28.—Cattle—
Receipts 4,400; lower; native \$6.75@8.25;
\$8.40; cows and heifers \$3@8. Western steers
\$6.75@8.25. Texas steers \$6@7.65; cows and
heifers \$5.75@7.50; calves \$7.75@9.75. Hogs—
Receipts 6,700; lower; heavy \$8.20@8.35;
light \$8.30@8.40; pigs \$7.40@8; bulk \$8.25@
8.35. Sheep—Receipts 12,000; steady; year-
lings \$7.25@8.90; wethers \$6.40@7; lambs
\$8.25@8.90.

Miscellaneous Markets.
GRASS SEEDS (Per 100 Lbs.)—Dull and
unchanged; some demand for millet and
good timothy, but no call for clover. Prices
easy or nominal; offerings next to nothing.
Quote: Millet—Trashy, mixed, etc.,
@1.40; clean, sound @1.10; timothy @1.30;
Hungarian @1.15@1.30; timothy at \$1@2
for tallings to \$2.25@2.50 for trashy, \$2.90
@3 for fair and \$3.20@3.35 for prime; clover
at from \$5@10 for weedy to \$15 for the bet-
est; average run; redtop at \$8 for the best
cleaned seed in grades; trashy, etc.,
less. No offerings worthy of mention on
regular market; order business only fair.

STOCK PEAS—Quotable per bu. at from
\$1.50 to \$1.80.
SORGHUM-CANE SEED—Quotable at 90c
to \$1.10 per 100 lbs. according to quality.
SUNFLOWER SEED—Quotable at \$2.75@
3.50 per 100 lbs.

ONION SETS—Bottoms quotable at \$1.40
per bu. for red and yellow and \$2 for white
—tested, less orders higher.
DRIED FRUIT—Little or none offering;
prices nominal; sun-dried quarters apples at
2@2½c; evaporated rings apples at from 3c
for ordinary to 4c for choice; sun-dried
peaches at 5c to 5½c; cores and peelings
apples ½@¾c.

BEANS & PEAS—Quote, on orders:
White beans—Choice hand-picked at \$2.40;
prime at \$2.30; screened at \$2.10@2.15—
inferior and artificially dried \$2.05@2.10;
black-eye \$2@2.15 for Southern to \$2.80@
2.90 for California; Scotch peas at \$1.75 per
bu.; split peas at \$2.70 per bu. for yellow
and \$3.25 for green; pink beans 5½c per
lb.; lima beans 5½c; lentils 5c; red kidney
4½c.

CASTOR BEANS—Nominal at \$1.50 per
bu.
HONEY—Quote Southern extracted and
strained—Bright amber in blcs. 6c per lb.;
in cans 6½@7c; dark ½c to 1c per lb. less.
Comb—Amber 14c; dark and inferior 9@11c
per lb.; broken and leaking 7@8c; fancy
clover 15@16c; very dull.

SORGHUM—Prime quotable at 40c per gal.
SALT—Quote: Granulated \$1.10 per bbl.
and medium \$1.15 tr. this side.
ROOTS—Quote golden seal \$3.35; lady
slipper 14c; Seneca 36@38c; pink 20c; black
7c—damp, dirty less; May apple 4c; snake
24@26c; tincture and leafy less; Kansas
black snake (Echinacea) 10c; split root
half price; Oklahoma black snake 9c—Mis-
souri worthless; Angelica 5c; wahoo bark of
root 20c—bark of tree 5c; blood 4½c; blue-
flag 2½c; sassafras bark of root 5c; wild
ginger 6c; blackberry 3c; wildcat leaves—
bright 9c, but dark less; wild ginseng \$6.25
@6.50; cultivated do. \$1@2.50.

BROOM CORN—Firm. Good demand for
all grades at the following prices: Quote
per con. at first hands, on trk.: Dwarf—Fair
\$6@6.50; standard \$6.75@7.50; light green hurl
\$8@9; standard brush—Fair \$6@6.50; root
dium \$8@9; choice at \$9@10; common,
crooked, damaged, discolored, etc., less.
POP CORN—On cob, per 100 lbs., at from
\$1 to \$1.60—latter for choice rice; inferior
less.

NUTS—Quote: Pecans at 7c to 8c per lb.
Peanuts 3@3½c per lb. for farmers' stock.
MOSS—Quote, per lb.: Gray mixed 1½@
1¾c; gray, brown and black mixed 1¼@2c;
black and black mixed 2@2½c; machine-
picked 3@4½c; xxx 4½c; xxx 5½c
5½c—inferior less.

RUBBER BAGS, ETC.—Country bags 80c
per 100 lbs.; old rope, manila \$1.50; com-
mon 40c. Rubber—No 88; arctics—trimmed

DEALINGS IN COTTON FEATURE

New Low Ground Is
General Selling an
able Report

New York, April 28.

In the cotton market to
regularity of May notices
about 80,000 bales.

It was reported that hou-
erpol connections and lo-
ple were taking up the cob-
was a good demand for M-
early trading, but no ag-
port developed and the
new low ground in the la-
der renewed general sel-
vorable new crop or wea-

The market opened 6 po-
2 points higher, sold 4 to
higher, and closed stead-
vance of 7 points on Apr-
ally 6 to 13 points unde-
figures of Saturday.

New York Cotton Quo-
Reported by Francis, Bro. &
Fourth street.

| Month. | Open. | High. | Low. |
|--------|-------|-------|-------|
| Jan. | 11.08 | 11.14 | 10.99 |
| Mar. | 11.13 | 11.13 | 11.03 |
| May | 11.26 | 11.44 | 11.22 |
| July | 11.40 | 11.33 | 11.32 |
| Aug. | 11.27 | 11.38 | 11.20 |
| Sept. | 11.17 | 11.17 | 11.05 |
| Oct. | 11.11 | 11.16 | 11.08 |
| Nov. | 11.13 | 11.19 | 11.09 |
| Spot | 11.70 | | |

St. Louis Cotton M-

Tone of market dull, uncha-
bales.
Ordinary.....
Good ordinary.....
Low middling.....
Middling.....
Good middling.....
Middling fair.....

Tinges ¼c to 1c off from
Receipts at principal points
Galveston, 2,909 bales, ag-
year.

New Orleans, 1,097 bales,
last year.

Mobile, 1,317 bales, against
Savannah, 1,933 bales, ag-
year.

Charleston, 381 bales, again
Houston, 3,550 bales, ag-
year.

Memphis, 606 bales, against
Net receipts at all United S-
three days were 18,226 bales,
bales 70,015 and 28,535 bal-
ported 70,153 bales, against
Stock 605,614 bales, against
Total receipts from Sept. 9-
9,019,799 bales, against 11.3
the corresponding period the
Local warehouse statement;

Stock on hand Sept. 1.....
Net receipts since Sept. 1.....
Net receipts yesterday.....
Net shipments since Sept. 1.....
Net shipments yesterday.....
Stock on hand.....
Gross receipts yesterday.....
Gross receipts since Sept. 1.....
Gross shipments yesterday.....
Gross shipments since Sept. 1.....

Cotton at Liverp-

LIVERPOOL, England, A-
—Spot in fair demand; pri-
dling fair 7.25c; good midd-
dling 6.70c; low middling 6.
nary 6.20c; ordinary 5.88c.
cluding 500 for speculation
7,700 American. Receipts 5.
can. Futures opened stead-

W.L. DOUGLAS
\$3.50, \$4.00 & \$4.50
SHOES

THE LARGEST MAKER OF MEN'S \$3.50 & \$4 SHOES IN THE WORLD

Look in W. L. Douglas store windows and you will see shoes for \$3.50, \$4.00 and \$4.50 that are just as good in style, fit and wear as other makes costing \$5.00 to \$7.00, the only difference is the price. Shoes in all leathers, styles and shapes to suit everybody. If you could visit W. L. Douglas large factories at Brockton, Mass., and see for yourself how carefully W. L. Douglas shoes are made, you would then understand why they are warranted to fit better, look better, hold their shape and wear longer than any other make for the price.

The Best \$2.00 and \$2.50 Boys' Shoes in the World.

CAUTION See that W. L. Douglas name is stamped on the bottom.

TAKE NO SUBSTITUTE.

If W. L. Douglas shoes are not for sale in your vicinity order direct from the factory and save the middleman's profit. Shoes for every member of the family, at all prices, by Parcel Post, postage free. Write for Illustrated Catalog. It will show you how to order by mail and why you can save money on your foot wear.

W. L. DOUGLAS, Brockton, Mass.

DOUGLAS SHOE CO.: 616 Olive St., St. Louis

THREE PLUN SCAFFOLD,

Two Others, Wor
Get Fractured
Broken L

VICTIMS CARRIED

Workmen Fall Thi
and Cries Bring
to Their

One man was injured and two others serious on a scaffold on which the teaming at the William Gray company, Second and Rutger way yesterday afternoon feet.

Joseph Ferris, who had but a short while, and was unknown to his fellow workmen, unconscious at the City hospital, fractured skull and internal injuries.

James Dixon, 33 years old, of 3820 Page boulevard, was broken, and the left leg broken in two places. The teaming was taken to St. Mary's hospital.

The three men were on a scaffold inside a big steel tank they were building.

Enos Konoskia, the one who fell, but could not get up until the other men, who were on the tank, brought ladders and helped him inside the tank. They were up a line of men forming a ladder.

ED: Can you take a hint? at Loftis' for \$1 a week, 2d fl.

CAN'T QUIT SURE

High State Court Request to Quit Man
JEFFERSON CITY, Mo., The Supreme Court in and refused the application of J. D. Shewalter of Independence his name withdrawn from the bar of the court.

Why Judge Shewalter left his name stricken from the court does not appear in the day's proceedings, and entry of the request and the court.

When the habeas corpus R. Nelson of Kansas City brought to the court, see

INDIA TEA

Strength and Richness
Deal to Coffee Drinkers

Stock No. 10.

Balsam Fir.

Cotton at
LIVERPOOL, England
—Spot in fair demand
—fine fair 7.23c; good
fine 6.70c; low middl
ary 6.20c; ordinary
lvdng 500 for specul
2004

[illegible]

but prices showed the change in the time
\$10.50 was registered of the same
fair to good grades of veals and skin-
\$9 to \$12.50, poorer classes and skin-
lines were \$8.00 to \$11.00 ready,
that would have made good kills
Medium weights of quality changed
from \$1.25 @ 9; heavies, of fair to
grade sold from \$6.25 @ 7.

There was a fair comparative easy pick-up of the 5% interest rate. The 5% interest rate was scarce.

THREE PLUNGE V SCAFFOLD, 1 D

Two Others, Working in
Get Fractured Ribs
Broken Leg.

VICTIMS CARRIED UP LA
Workmen Fall Thirty Fe
and Cries Bring Fore
to Their Aid.

One man was injured probab
and two others seriously hurt
scaffold on which the three we
ing at the William Graver Ta
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Enos Konoski, the forema
until the other men, under h
tion, brought ladders and lowe
inside the tank. They were the
up a line of men formed on e

ED: Can you take a hint? You can
at Lottus for \$1 a week, 2d floor, 308
39 DIVORCES ARE GR
Seven New Suits for Marital
Are Filed.

Divorces granted yesterday
Dudley F. from Mary M. Will
B. from Frank J. Swatek, John
Annie Mallon, Emma from W.
Patchin, Mary N. from Thomas
Eva A. L. from Robert Bisho
beth from Peter McNally, J
from Orlando Gardner, Ma
Thomas Smith, Lulu from R
Buesing, Carrie from Levi Key
from W. E. Long, Alma fro
Raymond, Mary D. from John
Minnie from George V

INDIA TEA length and Richness to Coffee Drinkers

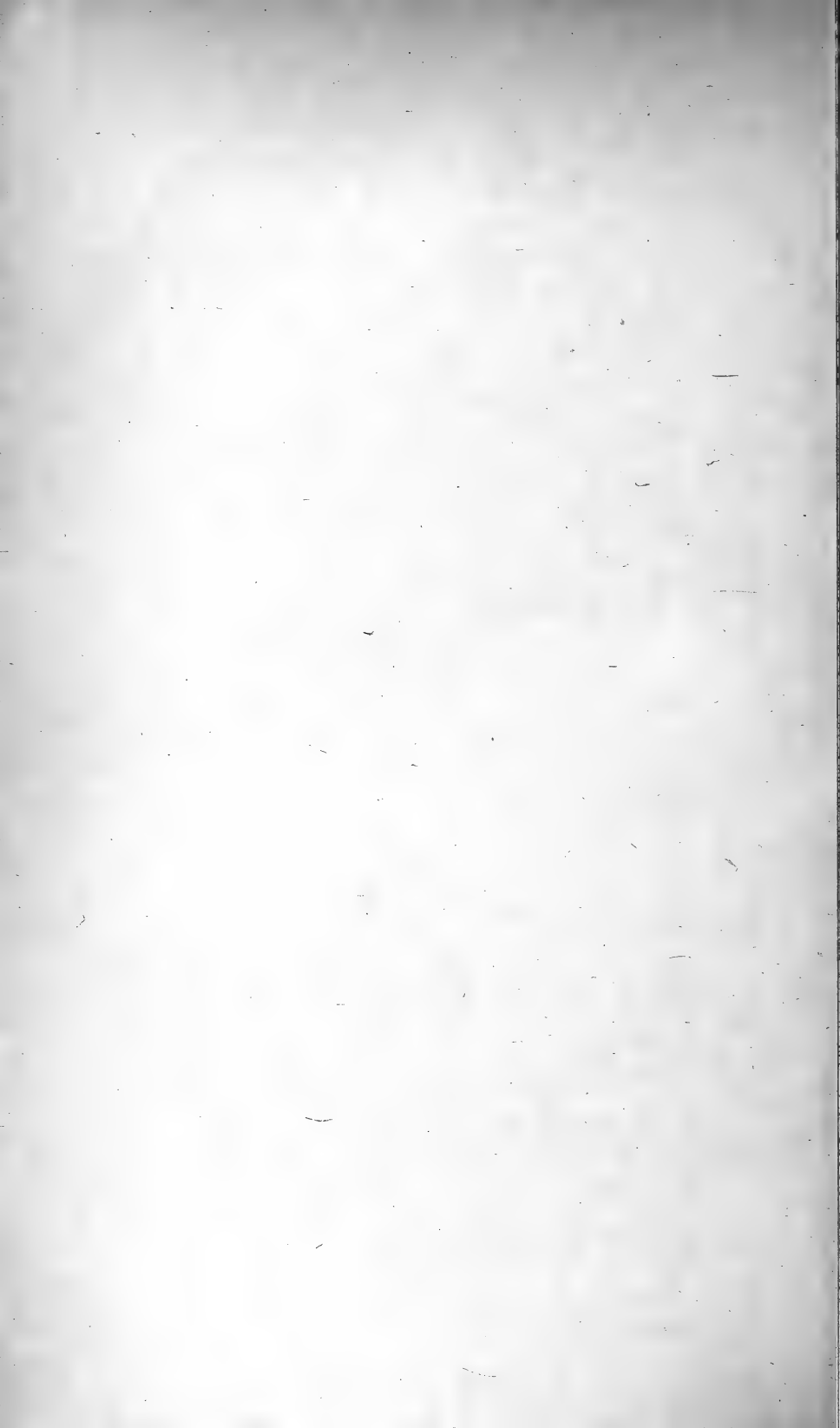
GLAS SHOE CO.; 616 Olive St., St. Louis

W.L. DOUGLAS
\$3.50, \$4.00 & \$4.50
SHOES
THE LARGEST MAKER OF MEN'S
\$3.50 & \$4 SHOES IN THE WORLD
Look in W. L. Douglas store
windows and you will see shoes
just as good in style, fit and wear as
other makes costing \$5.00 to \$7.00.
The only difference is the price. Shoes
all leathers, styles and shapes to suit
body. If you could visit W. L. Douglas
factories at Brockton, Mass., and see for
yourself how carefully W. L. Douglas shoes
are made, you would then understand why
they are warranted to fit better, look
better, hold their shape and wear
longer than any other make for the price.
The Best \$2.00 and 2.50 Boys' Shoes in the World.
See that W. L. Douglas name
is stamped on the bottom.
TAKE NO SUBSTITUTE.
If W. L. Douglas shoes are not for sale in your vicinity
order direct from the factory and save the middleman's
profit. Shoes for every member of the family.
Write for Illustrated Catalog. It
will show you how to order by mail and why
you can save money on your footwear.
W. L. DOUGLAS, Brockton, Mass.

THE PROFESSOR
THE BULL FROG
THE BUBB

Stock No. 7.

Lodgepole Pine. --- California.



HER REPORT

recast by States.
N. D. C., April 28.—Forecast:
and warmer Tuesday.
ably fair.
and warmer Tuesday.
ably fair; moderate, varia-

generally fair Tuesday and
Fair Tuesday and Wednes-
outh winds.

Fair Tuesday and Wednes-
braska—Fair Tuesday and
day; not quite so warm

r Tuesday and Wednesday:

d warmer Tuesday. Wednes-

Tuesday and Wednesday:
ture; moderate, varia-

r Tuesday and Wednesday:
ire.

aken at 8 p. m., seventy-

| Dr. | Tp. | Mx. | Prec. | Weather. |
|-----|-----|-----|-------|-----------|
| N | 62 | 64 | ... | Clear |
| S | 75 | 82 | ... | Clear |
| SE | 52 | 58 | ... | Cloudy |
| W | 54 | 62 | ... | Clear |
| N | 56 | 58 | ... | Cloudy |
| W | 50 | 52 | ... | Cloudy |
| N | 50 | 50 | ... | Cloudy |
| NE | 54 | 56 | ... | Rain |
| N | 60 | 64 | ... | Clear |
| NE | 36 | 40 | ... | Cloudy |
| N | 58 | 66 | ... | Clear |
| NW | 50 | 54 | ... | Cloudy |
| N | 66 | 72 | ... | Pt cloudy |
| N | 48 | 48 | ... | Clear |
| NW | 46 | 46 | ... | Rain |
| N | 44 | 46 | ... | Cloudy |
| SE | 68 | 72 | ... | Clear |
| SE | 70 | 74 | ... | Clear |
| NE | 62 | 66 | ... | Clear |
| N | 44 | 44 | ... | Cloudy |
| NW | 74 | 74 | ... | Pt cloudy |
| SE | 64 | 68 | ... | Clear |
| N | 48 | 48 | ... | Clear |
| D.S | 70 | 74 | ... | Clear |
| SE | 72 | 78 | ... | Clear |
| NE | 62 | 64 | ... | Clear |
| NE | 42 | 48 | ... | Clear |
| S | 68 | 70 | ... | Pt cloudy |
| NW | 32 | 34 | ... | Cloudy |
| NW | 32 | 34 | ... | Clear |
| SW | 48 | 52 | ... | Clear |
| NE | 52 | 54 | ... | Cloudy |
| SW | 58 | 64 | ... | Clear |
| E | 68 | 70 | ... | Clear |
| SW | 84 | 88 | ... | Clear |
| NW | 70 | 70 | ... | Clear |
| SW | 68 | 74 | ... | Clear |
| NW | 42 | 52 | ... | Cloudy |
| N | 68 | 72 | ... | Clear |
| N | 62 | 62 | ... | Pt cloudy |
| NW | 64 | 70 | ... | Clear |
| E | 62 | 66 | ... | Clear |
| N | 62 | 68 | ... | Clear |
| SE | 64 | 68 | ... | Clear |
| SW | 60 | 68 | ... | Clear |
| W | 46 | 46 | ... | Cloudy |
| NW | 64 | 64 | ... | Clear |
| W | 72 | 80 | ... | Clear |
| NW | 66 | 70 | ... | Clear |
| N | 60 | 64 | ... | Cloudy |
| NW | 50 | 52 | ... | Cloudy |
| N | 70 | 74 | ... | Clear |
| SE | 54 | 64 | ... | Cloudy |
| W | 50 | 56 | ... | Clear |
| S | 54 | 68 | ... | Cloudy |
| SE | 56 | 58 | ... | Clear |
| SE | 75 | 84 | ... | Clear |
| SE | 68 | 68 | ... | Clear |
| E | 58 | 62 | ... | Cloudy |
| W | 86 | 90 | ... | Clear |
| NW | 46 | 46 | ... | Rain |
| NW | 52 | 54 | ... | Cloudy |
| NW | 78 | 84 | ... | Clear |
| NW | 54 | 56 | ... | Cloudy |
| S | 80 | 82 | ... | Cloudy |
| SE | 62 | 64 | ... | Cloudy |
| SW | 64 | 68 | ... | Clear |
| E | 64 | 68 | ... | Clear |
| S | 72 | 74 | ... | Clear |
| S | 80 | 84 | ... | Clear |
| W | 62 | 66 | ... | Clear |
| W | 54 | 58 | ... | Clear |
| SW | 64 | 68 | ... | Clear |
| W | 62 | 72 | ... | Clear |
| NE | 62 | 72 | ... | Clear |
| S | 64 | 66 | ... | Clear |
| SE | 48 | 50 | ... | Cloudy |
| N | 60 | 64 | ... | Clear |
| NE | 62 | 66 | ... | Clear |
| NW | 54 | 62 | ... | Cloudy |
| N | 70 | 74 | ... | Clear |
| SE | 70 | 70 | ... | Pt cloudy |



It's not good that counts—its water.
Spend a few dimes for CRYSTAL WATER
and be happy and healthy.

A Cooler Free.

Five Gallons CRYSTAL WATER 37½¢
in your office. 50¢ in your home. The dif-
ference to pay cost of delivery.

St. Louis Crystal Water and Soda Co

Main 600. **Stock No. 7** Central 396

FIRE INSURANCE

The Jefferson Mutual Fire Insurance Co., of St. Louis

OFFICE, No. 317 CHESTNUT ST.
Phone—Bell, Main 1665.

MERCHANTS' EXCHANGE
Kinloch, Central 581

This company begs to inform its members and the general public that
in position to write Fire Insurance after April 30, 1913, as heretofore.
servative policy of underwriting will be carried out as in previous years.
If you have desirous business to offer, call or phone and we will be
service.

The following well-known business men compose its officers and directors.

| DIRECTORS. | | |
|-------------------|------------------------|------------------------|
| Wm. G. Mueller | Wm. Koenemann | Gustav Bischoff |
| Otto J. Wilhelmi | Otto F. Stifel | Henry J. J. J. J. |
| Christoph Hilke | F. W. Hoffmeister | Frank W. Fuernberg |
| Aug. F. Klasing | Henry Griesedieck Jr. | Ernst Harman |
| Aug. F. Klasing, | Julius L. Winkelmeyer, | Julius L. Winkelmeyer, |
| President | Vice-President | Sec'y and Treas. |
| C. Kraleman & Son | AGENTS, | Oscar J. Wendt, |
| Miss Alice Wegman | Otto A. Hambe | Asst. Sec'y. |
| Chas. T. Bessehl | Adolph T. Prag | H. von Heinrichs |
| | Matthias Becker Jr. | Henry Schubert |
| | | Schiele & Kleinsch |

All trains will be Resumed St. Louis to the East via BALTIMORE & OHIO Southwestern R. R. Effective at Midnight Sunday, April 27

With the exception of "Queen City Limited," leaving St. Louis at
which has been annulled for the present.

F. D. Gildersleeve.
A. G.

KIEL MEETS B. P. I. ON BOAT PROTESTANTS FORM

Mayor Makes Trip to Chesley Island on Erastus Wells.

The harborboat Erastus Wells, the
vessel on which former Mayor Kreis-
mann and his "cabinet" of advisers
met and discussed city affairs almost
weekly last summer, was the scene yester-
day of a similar conference between
Mayor Kiel and members of the Board
of Public Improvements.

The main object of the trip was an in-
spection of Chesley Island, one of the
sites suggested for a municipal gar-
bage-reduction plant.

Accompanying the party was J. T.

Joint Commission of Two Adopts Merger Plan

COLUMBUS, O., April 28.—
commission of the Protestants
and the United Brethren in
session here to-day, have
adopted a basis of union of
churches, forming a new de-
to be known as the United
Church.

The report of the commission
be ratified by the general con-
of their respective churches.

graduates: Misses Mattie Con-
Wright, Letha E. Hard, Nellie
srs. George Wilton, William G.
Ryan and Russell Carter.

LOUIS COUNTY.

Food Business Men Banquet.

Food Business Men's Association
rd annual banquet last night at
in Maplewood. Addresses were
recounting Attorney Lashly and
re G. A. Wurdeman.

ELEGATES IN SESSION

Meeting Refers Free Bridge to Various Organizations.

Elegates representing fifteen
nizations attended the regu-
ly meeting of the Central
ncil at the Public Library
ast night.

Gundlach spoke in favor of
o buy ground for more parks
ig the cost assessed against
rty that was benefited by
blishment.

Ninn, superintendent of the
Lodging-House, told of the
mplished by that institution
ed the establishing of a larger
central part of the city.

Elegates approved the bill for
vement of the street car serv-
posed the repeal of the Pub-
ce Commission. The Free
ngle was referred to the varl-
izations.

Is providing for the ventila-
treet cars, for the wrapping
and for the disposal of ashes,
ing, were approved.

AS AUTO RACERS HELD

Quick Causes Arrest of Two in White Slave Case.

GELES, Cal., April 28.—Delv-
r into the white slave bands
ngeles the police to-day ar-
William Le Casse and Richard
orth, automobile racing driv-
charges preferred by Evelyn
15-year-old schoolgirl.

se was arrested in the apart-
a former society woman,
isband is now suing for di-

ollingsworth tried to evade
t barricading himself in his
t the police tore down the

Old Asked to Succeed Dunn.

me of Capt. William J. Mac-
r the office of Supervising In-
f Steamboats in the St. Louis
to succeed Joseph J. Dunn,
a few weeks ago, was sent
enate last week. Capt. Mac-
is been United States Inspector
boat Boilers in this district
x years. The promotion will
vacancy in the office of Inspec-
boilers. This will be filled by
ent from the civil-service list
ansfer from another district.

Heads Banking Institute.

annual election of the St. Louis
of the American Institute of
last night the following offi-

walked out of the shop on a strike because
the company has failed to employ union men
in the polishing room.

MARQUETTE RECEIVER ASKED

Court Is Petitioned to Remove Officers of Downtown Hotel.

Arthur Thacher applied to the Circuit
Court yesterday for a receiver for the
Glancy & Watson Hotel Company, which
conducts the Marquette Hotel, at Eight-
eenth street and Washington avenue.

The company is capitalized for \$100,-
000. Thacher owns ten shares of the
stock and T. H. Glancy, president and
manager, owns 750 of the 1,000 shares.

The company was organized in Feb-
ruary, 1907, with Glancy and M. D.
Watson managers at salaries of \$3,600
a year, it is stated. Glancy bought Wat-
son's interest in August, 1910, and has
been drawing \$800 a month salary, it
is asserted.

The court is asked to remove Glancy
and the Board of Directors and require
an accounting.

Engineers Discuss St. Louis Chapter.

Charles F. Rand and Bradley Stough-
ton, president and secretary, respec-
tively, of the American Institute of Min-
ing Engineers, were entertained at a
dinner at the St. Louis Club last night
by Missouri and Illinois members of
the association. The advisability of or-
ganizing a local chapter of the insti-
tute as a "get-together proposition" for
Missouri and Illinois engineers was dis-
cussed. Both Mr. Rand and Mr. Stough-
ton addressed the diners, while other
speakers were former Gov. D. R. Francis,
H. A. Buehler, State Geologist, of
Rolla, Mo., and Capt. R. W. Hunt of
Chicago.

Poultry.

NEW YORK, April 28.—Live Poultry.—To-
day is the Hebrew Last Passover, and with
the buyers absent, there was no business
and no poultry was unloaded. Some 9 cars
arrived on trk., but will not be unloaded till
to-morrow.

Dressed. Poultry.—Receipts 1,438 pigs.
Very little fresh-killed poultry here of any
description, a few lots of fowls went at
18½@19c, but large fowls are difficult to
strain up to 18½c. Old roosters scarce and
firm. Squabs a trifle easier and only fancy
exceeding \$4 on an 8-lb. average. There
were a few lots of frozen fowls thrown on
the market and held up a price, but buyers
are reluctant to pay that price, and very
little business reported. Frozen roasters
held with more confidence. Frozen turkeys
active.

Fresh-Killed Poultry.—Dry-packed turkeys,
hens, av. 22@23c; toms, young, av. 22c;
do, old 21c.

Fowls.—Box-packed, 12 birds to box: West-
ern dry-picked, 60 lbs., 10c; do. 48@53 lbs.,
19c; do. 36@42 lbs., 17½@18½c; do. under
36 lbs., 10@16½c; do. bbis., over 5 lbs.,
18½c; do. 4 lbs. each, 18½@19c; Western
dry-picked, iced, 18½@19c; do. bbis., 3@3½
lbs. each, 17@18c; do. bbis., Southern and
Southwestern, 17½@18½c; scalded, bbis.,
other Westerns, av. 17½@18½c.
Old Roosters.—Dry-picked 14½c; do. scalded
14½c.

Squabs.—White, fancy, 10 lbs. to doz.,
\$5@5.50; do. 9 lbs. to doz., \$4.50@4.75; do.,
8 lbs. to doz., \$4.45; do. 7 lbs. to doz.,
\$3.25@3.50; do. small, \$2½; do. 6½ to doz.,
\$2.25@2.50; do. 12½ to doz., 65@75c.

Guinea Fowls.—Old, per pair, 85@90c; do.
young, per pair, \$1@1.15.

Frozen Poultry.—Turkeys.—Young toms,
fancy, under 16 lbs. each, 25½c; do.
over 17 lbs. each, 24½@25c; do. av. mixed
sizes 23½@24c; do. Texas and small, West-
ern 22@23c; young hens, fancy, per lb.,
23@24c.

Fowls.—Dry-picked, No. 1, 60 lbs. and over
to doz., 19c; do. 45@55 lbs. to doz., 19c;
do. 22@42 lbs. to doz., 18½c; do. under 22

keys 16c; small and chickens 19c;
cocks 16c; chickens 19c;
6c to 10c; ducks 13c; ca 17c.

PIGEONS AND SQ
pigeons at 75c per doz. S
ers (7@8 lbs. to the do.
large homers (9@10 lb
some small sold at \$3;
and dead pigeons 60c pe

VEALS.—Market firm
few offered, but receipts
arrive until about noon
for choice medium weigh
lbs. 9c per lb.; do. 150 l
180 to 200 lbs. at 8c; rou
tics of over 200 lbs., a
under-weight, at 6@7c.
bucks at 3½c. Yearlin
for fat to 8½c. 7½c for
lambs.—Choice fat, weigh
at \$4.50 per head; sh
Sheared sheep sell at 1c
than full-weighted.

ROASTING PIGS.—Qu
at \$2@2.25; 25@30-lb. a
FRESH.

3½@4½c; do.
dressed, large, 6c; do.
dressed, 4c; do. 3c; su
large, 11c; do. medium
black bass, 2½ lbs. and
@2½ lbs., 10c; do. ord
12c; spoonbill cat, 4@10
and over 1½c; do. 10c
large, collar bones off,
lar bones on, 9c; bullhea
collar bone on, 6c; white
do. round 2½c; grass pig
shell turtle, dressed, 7c;
meat 3½c; frogs, large,
medium 75c; do. small

Hides, Furs.

FEATHERS.—Prime w
prime gray do. 44c; o
27@31c; xx 15@18c; x
tare 10c per cent on 10
large, Duck, 15@18c; W
Prime dry-picked bod
quill-mixed 2c. Turkey
quill-mixed 18c.

BEEFWAX.—Quote pr
impure and inferior less

SHEEP PELT.—Quote
\$1 each for green or d
spring lambs at 10c to
kill. Dry 10c per lb. f
sandy and heavy.

GOAT SKINS.—Quote
5@15c.

WOOL.—A few small
arriving and selling on
given herewith; market
and accurate prices no
The trade awaiting a se
question; besides shear
Quote, nominal price
17c for low to 18
12c for heavy to 16
15@17c; burry 11@18
for slight; Southern
burry to 17c for clear,
do 16c and fine 16c
medium 16@17c; do. h
ern or Western 17c
bright medium; 10c to
for hard burry to 16c f
20c for burry to 25c fo
15c for burry to 25c fo
for low lustrous.

TO GROWERS OF
D successfully with forei
realize top market pri
put the wool in prop
tion. The wool must be
it is sheared, and very
in fleeces with a light
After all dung, skirts a
ter practicable is remov
separate from burry, m
fine, etc., and otherwise
as possible for manuf
FURS.—The season
as prices are more pr
ues. Current receipts
coon 25c to \$1, mink 35
to 50c skunk (Central 35
rat (do.) 40c to 45c, c
cat 10½ to 15c, gray fox 8
@4; wolf 25c.

HIDES.—Market inae
ners buying only for
Green salted in light
good many "shedders"
ble. Dry quoted.

Wet Salted.
Round 134
No. 1 132
No. 2 124
Bull 104
Glue stock 84

Uncured or fresh 1½
cured 4c per lb. less
horse hides \$8.50 each
and pony 1.50@2; ho
pigs half price.

London Val
LONDON, April 28
demand for the vari

Stock No. 8.

Red Fir.



and Delmar avenues, was told to-day to the Legislative Investigation Committee by a 16-year-old girl who identified herself as "Irene G."

Witness was 15 years old when she went to the home, to work for her keep, medical attention and her approaching accouchment.

"I was forced to scrub floors and lift heavy trunks the day my baby was born," she declared.

She said that an overworked doctor at the home had expressed to her the fear that he would be unable to perform properly the necessary obstetrical operations when her baby was born. This proved true, she said, for one eye of the infant was punctured by an instrument.

Witness was at home nine months, she said, and she worked at scrubbing floors and waiting on table till she dropped from exhaustion. The food, she asserted, was scant and very bad, often unfit to eat.

Overwork and hardships impaired her health, she said. The girls had to attend chapel three times a day, and when they were ill they didn't feel like kneeling down and have visitors pray "at" them.

Marcia Berlyn Weinberg, who was dentist of the home for a year, testified she had criticised the practice of making girls scrub floors until the day their babies came into the world.

She asserted the head of the institution had once scored the girls in a sermon, declaring that they should "be forced to eat under the table, like dogs."

WAGE COMMISSION TO MEET.

Chairman Calls Members to Gathering in St. Louis May 15.

Michael J. Kinney, chairman of the special committee created by the Missouri Legislature at its last session to inquire into wages, working and living conditions in the State, yesterday issued a call to the committee to assemble in St. Louis May 15.

The investigation will be similar to that recently conducted by the Illinois Vice Commission.

The examination of witnesses will begin soon after May 15 and will include factory and department store owners and managers and attaches of all kinds of industrial plants where a large number of persons, especially girls, are employed.

The testimony will be submitted to the Legislature.

LOWER CALIFORNIA

Propose to Annex Possession.

April 28.—Declaration of Lower California Government by a group of capitalists, W. J. [unclear] property owner at [unclear] the bay from Ensenada, California, announced the deal would be concluded that annexation by

\$200,000 FOR CANCER CURE

Henry Rutherford Leaves Rockefeller Institute Special Bequest.

NEW YORK, April 28.—The Rockefeller Institute for Medical Research is left \$200,000 by the will of Henry Rutherford of Grand Isle, Vt., who died here February 26.

The will was filed here to-day. The income of the bequest, the testator says, is to be used to find a cure for cancer.

which that body will operate under the rules which were prepared and after the commission came into existence, April 5, and soon of the hands of the printer for distribution.

The synopsis of the rules

Any public utility coming under the dictation of the commission must submit a copy of the new public-service copy of the rules of the commission, and also any attorney who desires a copy of either may request to the commission.

The rules, as adopted by the commission, abolish all technicalities in procedure that body. A plain statement of complaint is required to be made by the complainant. Complaints are decided at any time in the discretion of the commission.

The commission will hold regular sessions at its office in Jefferson City, first Tuesday in each month, commencing at 10 o'clock in the morning. Under the rules, the commission is open to the transaction of business every day of the week except on legal holidays. Other sessions of the commission will be held in Jefferson City elsewhere, as the business requires.

No rate of any public utility can be increased after April 15 unless the law became effective, without notice and consent of the commission.

One of the strongest features of the commission is the supervision to be exercised in the issuance of stocks, bonds and public-service corporations of the State.

In addition to scrutinizing the accounts for which such bonds, notes are to be issued, the commission requires an itemized statement of expenditure of such moneys, verified by some officer of the public service, to be filed with the commission at the end of each six months, showing the position has been made of the sale of such stocks, bonds and

In this way the commission secures the moneys and obligations of public corporations on which the public has a return in rates should be invested and expended properly for the benefit of the public, as well as the utility.

The rules set out in full forms for complaints, applications and other matters before the commission, which will be of interest to lawyers practicing before the commission, and also to all utilities under the jurisdiction of the commission.

Under the rules, when a complaint is received an order of the commission that the party complained against satisfy the complaint or answer within ten days thereafter; also a copy of the complaint is sent the party against.

If at the end of ten days the party is not satisfied, then the commission will order for a public hearing, and the party complained against ten days of such time and place.

In this way it is hoped the burden of the commission will be expedited long drawn-out litigation.

Welfare Delegates Appointed

JEFFERSON CITY, Mo., April 28.—State Superintendent W. P. Egan today appointed as delegates to the eleventh Child Welfare National Congress of Mothers and Parent-Teacher Associations, which will meet in Boston, Mass., May 15-20, Miss Griffith, St. Louis; Miss Estelle Springfield, and Miss Ella V. I. Columbia.

throughout the col

ermosa Panamas—
98 and up.

**New Styles in
Summer Hats**
Hats in Panama, Leg-
hats are shown in the
new and clever styles
delight the little ones.
very moderate.

OR AND WIFE TO SHOP

**get Affairs of State and Visit
Downtown Stores.**

Mrs. Major will go shopping
for the brief space that lies
early shopping hours and
in the big stores, the Gov-
forget all about politics, ap-
insurance, tangles, and
gresses, while he aids Mrs.
ke purchases for the Exe-
nsion.

Friday I will be astride a horse
time," said the Governor late
t, "and a strenuous day of
will sort of prepare me for
als. Thursday I am to appear
the Peace Congress, so, alto-
will be busy enough while in

ernor is still considering his
ents for the Public Utilities
on.

a number of men in mind,"
"but I have made no decision."
used to comment on the avail-
of J. E. Allison for the fifth
that body, who is said to be
the many applicants for the

nd Mrs. Major will be the
Mr. and Mrs. Fred D. Gardner

PANKHURST JEERED

**Freedom Continues, Disap-
pointing London Crowd.**

DN, April 28.—The expiration of
ted license under which Mrs.
Pankhurst, the militant suf-
frage leader, was released April 12,
olloway Jail, where she was
three years' imprisonment,
a great crowd to assemble to
the house where she has been
to recover from the effects of
nger strike.

people's expectation of seeing her
returned to jail was disap-
the authorities having in the
decided to extend her license
to her unsatisfactory health.

Mrs. Pankhurst's feminine
started off from the house
ss Sylvia Pankhurst, during the
on, a hooting crowd tried to
e car.

Miner's Dog Dies of Grief.

women's conference about
of the minimum wage bill, initiative
and referendum, and the limited suf-
frage bill.

The women's conference and a meet-
ing of the State Central Committee
were the only meetings scheduled for
this morning.

B. F. Harris of Champaign tendered
his resignation as chairman of the
State Committee, resigning on account
of ill health. John F. Bass of Chicago
was elected to succeed him. Fred S.
Willbur of East St. Louis was elected
to succeed Mr. Bass as vice chairman.

H. L. Fordham of Dixon, who has
been acting treasurer of the committee,
was elected treasurer.

Joel F. Longnecker of Chicago was
elected member of the committee for
the First District, to succeed Chauncey
Dewey, who resigned some time ago.

TRIES TO "DUCK" HAYWOOD

**Crowd Threatens Labor Leader When
He Is Arrested in Passaic.**

PATERSON, N. J., April 28.—William
D. Haywood, leader of the Industrial
Workers of the World, was arrested at
Passaic to-day on his way here from
New York to surrender himself under
an indictment charging him with in-
citing riots among the silk mill strik-
ers.

Ten thousand strikers had gathered
at the Erie Railroad station here this
morning to meet Haywood and to wit-
ness his arrest, and to escort him to
the jail. Fearing a disturbance if the
arrest was made here, Sheriff Radcliff
arrested Haywood at Passaic.

The strike leader accepted arrest
calmly. He was brought here from
Passaic in an automobile and was re-
leased on bail soon after his arrival.
He hurried to Turner Hall to make a
speech to a big crowd of strikers.

When the leader was taken from the
train at Passaic, he was quickly sur-
rounded by a crowd, which shouted
"duck him in the river." The demon-
stration became so threatening the
Sheriff called on several policemen to
help him escort the prisoner to an au-
tomobile.

THOUGHT TRIAL WAS HEARING

**Husband Loses Divorce When Wife
Tells Why She Didn't Contest.**

Mrs. Margaret A. Gansz, 1074 South
Kingshighway, appeared yesterday in
Circuit Judge Rassieur's court and tes-
tified in the divorce suit of her hus-
band, John J. Gansz, 1829 Market
street, although she did not contest the
case.

She said her husband has been visit-
ing her every week.

She was asked by her husband's at-
torney why she did not contest the
suit. She said her husband told her
the case was not to be tried for sixty
days and that yesterday's proceeding
was only a "hearing." She thought she
had plenty of time, she said.

Gansz denied her statements and said
he had called upon her only a few
times about business matters.

question for mature
liberation."

William K. Bixby, o-
rative Commerce direct-
the article, has stat-
since the resignation
that he thought the e-
tion of the bank coul-
ness satisfactorily.

Simmons Takes S

E. C. Simmons, a
rector, who has serve
took a similar statu
was no need for has

Friends of Mr. Ra
during the last week
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all sections of the c
the hope that he wil
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Mr. Randolph decl
messages or discuss

He owns a large
stock in several othe
believe that if some
to the Commerce vac
the institution.

Autolists Arrested

Robert G. Kobusch
avenue, and Wesley C
street, were arrested
the automobile in
riding, collided with
at Bissell street and
nue. George Hentz
who were in the bu
thrown to the stre
bruises. Kobusch an
up at the Angelica
tion, charged with c

Forty-Two Pass

ANNAPOLIS, Md.
two candidates for
Naval Academy as r
cided to be accepta
Academic Board thi
lengthy session.

ONE DOSE INDIGES

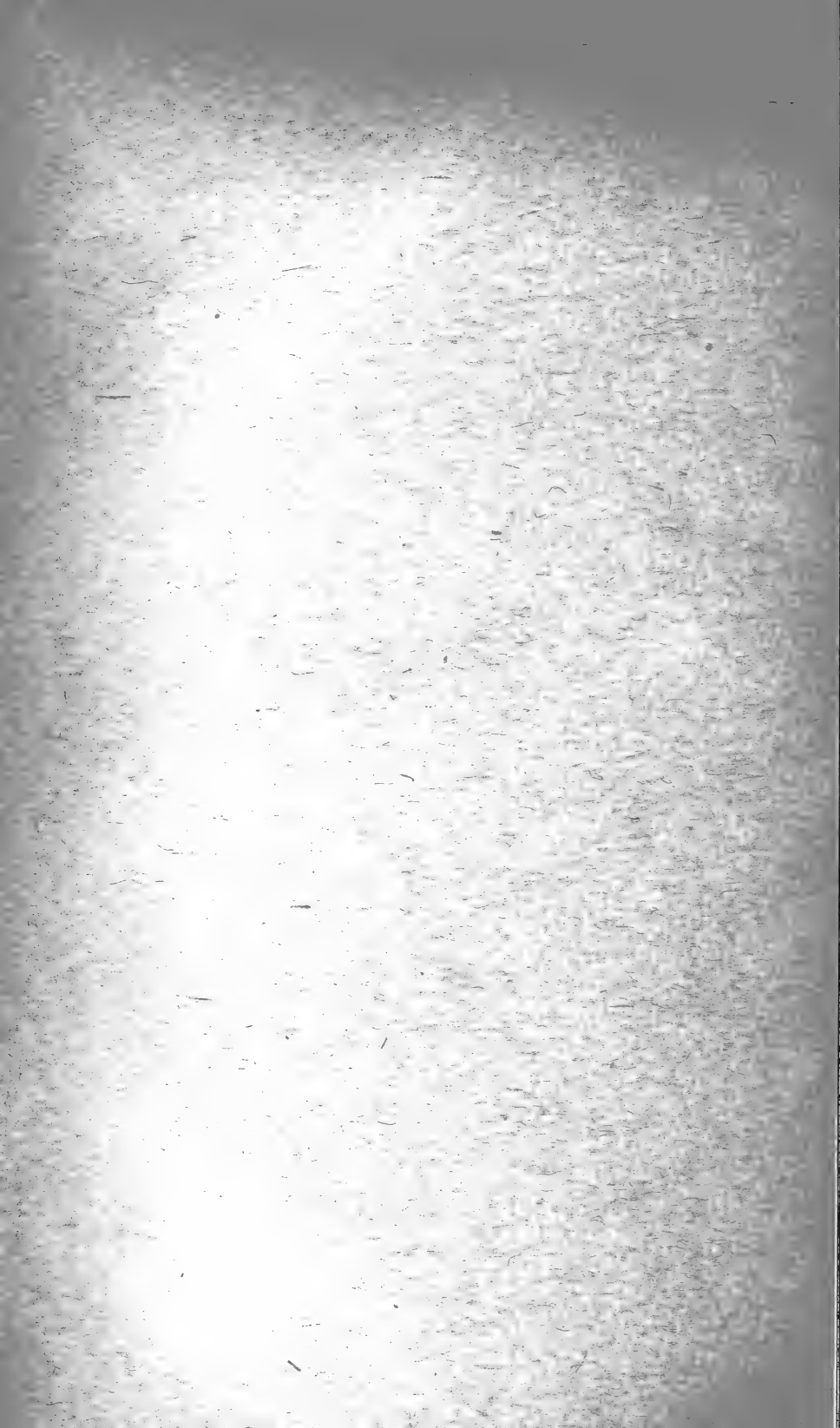
All Stomach ly ended vt Diap

You don't want
your stomach is
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is too valuable; w
with drastic drug

Pape's Diapepsi
speed in giving
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regulating sick, s
Its millions of
dyspepsia, gastrit
trouble has made
over.

Stock No. 9.

Hemlock.



one-fourth interest.
 KA—35 ft., n. s., bet. Compton
 Virginia, c. b. 2742; John E.
 rowski and wife to Simon J.
 (nski)
 30 ft., s. s., west of Grand,
 b. 2940; Becker Realty Co. to
 a F. Pfenninghausen.
 ADIE—50 ft., n. s., west of
 on c. b. 5247; Paul Haase by
 stee, to Joseph B. Niermann—
 s. d.
 30 ft., n. s., being 4329 Lee, c.
 573 W.; Mary J. Bottger and hus-
 and to William J. Beattie.
 AS—25 ft. s. s., bet. Garrison and
 upton, c. b. 1023; Stellar Realty
 to Cedars Realty Co.
 NESOTA—35 ft., e. s., bet. Mag-
 na and Pestalozzi, c. b. 1428; Eliza
 Hutchinson and husband to
 Wm. N. Hutchinson.
 MOURI—50 ft., e. s., bet. Cherokee
 Potomac, c. b. 1555; Emma
 wler to Hilda Schwieler et al.
 CHESTER—50 ft., n. s., bet. New-
 and and Taylor, c. b. 5108; Ella
 ler to Arthur C. Schacht.
 CHESTER—50 ft., n. s., bet. New-
 and and Taylor, c. b. 5108; Lynna
 ally and Investment Co. to Ella
 ler.
 NESOTA—35 ft., s. s., bet. Mag-
 na and Pestalozzi, c. b. 1428; Wil-
 m. N. Hutchinson to Frank Hutch-
 son and wife.
 CHESTER—50 ft., n. s., bet.
 ver Grove and Westcote, c. b.
 2B; Joseph G. Doyon and wife to
 C. Higley.
 GAN—76 ft. 5 in. s. s., west of
 nty-first, c. b. 938; Mary A.
 to Alvin W. Boeckmann.
 GUS—30 ft. 4 in. n. s., bet.
 Margaretta and San Francisco, c. b.
 28; Harry R. Walchli and wife to
 lus Galtzsch and wife.
 LEAD—24 ft. 8 in., e. s., be-
 3004 N. Newstadt, N. b. 3619;
 Ma Comer and husband to Earl A.
 Maur.
 TH MARKET—25 ft., s. s., being
 North Market, c. b. 3696; Gus-
 C. Woelfer Sr. and wife to Otto
 fier.
 TH MARKET—25 ft., s. s., be-
 southeast cor. Prairie, c. b. 1871;
 Ma Kros to Minnie Wuest.
 TH MARKET—25 ft. 1 1/2 in. s.
 e. cor. Prairie, c. b. 1871; Min-
 Wuest to Board of Education—
 w. d.
 POLA—30 ft., s. s., bet. Gravois
 Morgan Ford, c. b. 5327; Sedge-
 Investment Co. to Henry C.
 and wife.
 40 ft., n. s., bet. Academy
 Union, c. b. 8792; Standard
 Realty Co. to Joseph Goldstein and
 Eder.
 SELL—50 ft., n. s., bet. Law-
 and and Thurman, c. b. 1844;
 ngen H. Jurgens and wife to Al-
 Falpenhainer and wife.
 TH STRIP—100 ft., n. s., west
 De Baliviere, c. b. 5539; Forest
 Land Co. to William E.
 TH STRIP—100 ft., n. s., west of
 e Baliviere, c. b. 5539; Forest Park
 and Co. to William E. Fughes.
 TH STRIP—100 ft., n. s., west
 De Baliviere, c. b. 5539; Forest
 Park and Co. to Wm. W. Hughes.
 TH STRIP—100 ft., n. s., west of
 e Baliviere, c. b. 5539; Forest Park
 and Co. to W. K. Bixby.
 TH STRIP—100 ft., n. s., east of
 Bunker, c. b. 5539; Forest Park
 and Co. to W. K. Bixby.
 TH STRIP—100 ft., n. s., west of
 e Baliviere, c. b. 5539; Forest Park
 and Co. to W. K. Bixby.
 TH STRIP—100 ft., n. s., west of
 e Baliviere, c. b. 5539; Forest Park
 and Co. to Daniel Catlin.
 TH STRIP—150 ft., n. s., east of
 e Baliviere, c. b. 5539; Forest Park
 and Co. to Daniel Catlin.
 TH STRIP—100 ft., n. s., east of
 Bunker, c. b. 5539; Forest Park
 and Co. to Daniel Catlin.
 THERLAND—30 ft., s. s., bet.
 Kingshighway and Brannon, c. b.
 1665; Elene M. Harris to Stephan C.
 Jakoubek and wife—all
 interest.
 LLIVAN—25 ft., n. s., being 2718
 Sullivan, c. b. 2374; Fred Groth-
 mann and wife to Mary Duerbeck.
 ERIDAN—30 ft., n. s., being 3123
 Sheridan, c. b. 1984; Ben Rubins and
 wife to Michael Smith.
 THERLAND—30 ft., s. s., bet.
 Kingshighway and Brannon, c. b.
 1665; Elene M. Harris to Stephan C.
 Jakoubek and wife.
 NESSEE—90 ft., w. s., bet. Osceola
 and Neesho, c. b. 2780; Edna F.
 Burger and wife to Edna F. Burger.
 NESSEE—90 ft., w. s., bet. Osceola
 and Neesho, c. b. 2730; Edna F.

burg, Ind., twenty-five miles west of
 Cincinnati.
 The loss of the Lawrenceburg bridge
 was one of the most serious troubles
 experienced by the B. & O., during the
 high water, since it caused a break in
 the line and suspension of direct
 service between Cincinnati and St.
 Louis.
 The total length of the bridge was
 1,240 feet, of which 320 feet of steel
 work was swept away. Other bridges
 were lost also, but were repaired,
 and when replaced two weeks ago train
 service was restored between Cincin-
 nati and St. Louis by way of Louisville.
 Reconstruction work on the Law-
 renceburg bridge was seriously inter-
 fered with by the continuing swell
 of the Miami River, the swiftness of
 the current and other extraordinary
 conditions.
 Road Gets Bonus From Hot Springs.
 MURFREESBIRO, Ark., April 28.—The
 managers of the Memphis, Dallas &
 Gulf Railroad Company have accepted
 a \$60,000 bonus from Hot Springs and
 will extend the road to that city as
 soon as possible. About ten miles of the
 right of way has been laid out, and
 grading and laying of track will begin
 at once.
 Peoria & Pekin Meeting on May 1.
 BLOOMINGTON, Ill., April 28.—The
 annual meeting of the directors of the
 Peoria & Pekin Union Terminal Com-
 pany has been called for May 1 in Chi-
 cago. The election of officers, includ-
 ing chairman of the board, will be the
 principal business to come up. H. L.
 Pinkey is president.
 Building Permits.
 Thomas Kelly, 1110 North Eighth, wreck;
 \$1,000.
 M. K. & T. Ry., 1600 North Broadway,
 1601-09 North Second, 207 Mullanphy, alter
 freight depot; \$30,000.
 M. K. & T. Ry., 210 Mound, steel and
 wood platform; \$7,500.
 William Russell, 4354 Neosho, one-story
 dwelling; \$2,000.
 McLain O. Sanitarium, 907 Aubert, move
 office; \$1,200.
 M. E. Sheets, 4350-52 Gibson, two two-stor-
 y flats; \$8,000.
 William Havel, 1943-43A Lansdowne, two-
 story flat; \$3,500.
 John Holden, 3646-46A Lafayette, two-stor-
 y flat; \$6,000.
 William B. Iitner, 5553 Bartmer, one-story
 garage; \$500.
 J. C. Kupferle Investment Company, 827
 Cass, concrete foundation warehouse; \$2,-
 000.
 A. Skaggs, 2605-7-11 East Arlington, three
 two-story dwellings; \$6,000.
 Jessie Morris Realty and Investment Com-
 pany, 4532 Arsenal, two-story dwelling; \$5,-
 500.
 Landes Machine Company, 2500 Mullanphy,
 addition to factory; \$8,000.
 M. Szeponski, 3915-15A Marcus, two-story
 flat; \$4,500.
 H. W. Hamilton, 2338-42-44 Euclid, three
 two-story dwellings; \$9,000.
 B. Kaufmann, 6225 South Broadway, two-
 story flat; \$2,000.
 L. D. Blas, 5415 Neosho, two-story dwell-
 ing; \$1,500.
 St. Clair County Realty Transfers.
 John B. Simonin Sr., and wife to Lena A.
 Brueggemann, lot 7, block 3, Simonins;
 \$450.
 James M. Wilson to James F. Hazelrigg,
 lots 11 and 12, block 25, Alta Sita; \$1.
 Joseph N. Keys et al. to James F. Galvin,
 lots 13 and 14, block 24, McKimley;
 H. P. Taussan and wife to William Sheets,
 lots 20 and 21, block 6, Trendle Heights;
 \$2,000.
 F. J. Wagner and wife to M. R. Lyons,
 north 20 feet, lot 24, F. C. Hamilton's first
 addition, north division of Marissa;
 H. J. De Haan et al. to Anna E. Lewis,
 lot 2, block 1, Hamilton's second

usually known as
 was sold at, pay-
 \$3,000,000, the min-
 by the United St.
 the order for the
 probably will be
 tended as the D.
 Railway, was sol
 represented by
 and George H. B.
 from the foreclo
 held by the Ban
 Rocky Mountain
 The gross reve
 Rocky Mountain
 last month incre
 corresponding pe
 according to a stat
 the general offic
 March, 1913, th
 while in March,
 269.45. The net
 was \$35,807.33, or
 Railroad
 NEW YORK,
 earnings:
 C. N. O. & T. P.
 777, decrease \$6.06
 917, increase \$146.
 Louisville & Nasl
 \$1,875,825, increas
 \$48,057,482, increas
 Minneapolis &
 April \$179,158, inc
 1 \$8,061,713, incre
 Mobile & Ohio—
 459, increase \$80.4
 11, increase \$632.
 Rio Grande Sou
 \$13,789, increase \$2
 \$81, increase \$124.
 Southern Railway
 \$1,309,485, increas
 \$55,917,176, increas
 Northern Pacific
 com, \$5,619,874.
 earnings \$2,088,253
 net earnings \$2.08
 net income \$1,703.
 STOCKHOLM
 ST. LOUIS, IROH
 B. F. R. R. L
 Special Stockhol
 hereby given that
 stockholders of St.
 Southern Railway
 the principal offic
 Missouri Pacific b
 Louis, in the Sta
 day of June, 1913
 noon of that day,
 the following prop
 1. To consent t
 authorize the exec
 incidental to the S
 York and Benjam
 ties, supplemental
 ing mortgage of t
 1912, to Union Tr
 and Benjamin F.
 viding, among oth
 of a sinking fund
 chase for cancella
 of bonds at any
 ing under said m
 mental indenture
 der said refunding
 mental indenture
 stitution for the t
 sued under said
 the modification a
 recording, and m
 and to be issued t
 the form and ter
 indenture and of
 der said refunding
 mental indenture
 2. To ratify th
 Directors thereof
 matters aforesaid.
 3. To consider
 ness as may pro
 recting the same.
 The stock trans
 will be closed at
 day, the thirty-f
 will remain clos
 Wednesday, June
 Dated April 8, 1
 By order of the

per 112-bu.

Orleans (new) single
in size.
er, under larger offer-
demand; poor stock
Mississippi hampers at
5 hampers sold at \$2.
home-grown sold at 3c
southern shallots not

ote home-grown at
100s; orders higher.
1 sold loose at 15c per

rown leaf lettuce in
er, selling at 40c to
Louisiana flour bbls.

Quote choice New
doz. bunches.
Quote New Orleans
doz. to the bbl.) at
and 30¢ @ 35¢ doz. to the
ut; some sold at \$2.50

Quote Northern half-
in liberal offering.
crates at from \$2. for
new.

Steady; Alabama rad-
nasas stock too are
rich; fair demand for
Alabama red and white
z. bunches; Arkansas
white at 15¢ 25c per
g to size of bunches;
hes at 20¢ 30c for red

own higher at 25¢ 30c
ments not wanted.
Steady; fancy dark
note Florida hampers
83—spotted and poor
13¢ 2-3-bu. bxs.

—Seed season over-
price quotable. Home-
a. yellow and queen
semond at \$1 per bu.

ipe, Florida scarce. In
te sound ripe Florida
at \$3.50 per 6-basket
for choice; off stock

Light offering and
te old home-grown
box loose and un-
New Orleans at 10¢
and 20¢ 25c for large

ote city make in a
55c; half-bbls. \$1.10
casks \$3.50; orders

ce.
28.—Coffee futures
advance of 2 to 5
s; European cables
4 or 5 points; sur-
of shorts and sear-
anned to be promoted
razilian markets and
t demand. Offerings
sufficient to cause
ne positions in the
close steady. Sale
11.13c; June 11.23c;
6, Sept., Oct., Nov.
11.49c; Feb. 11.50c;
rice steady; Rio 7s
initial. Hays to 7s
unchanged. At 7s
reis higher at 68¢ 75.
razilian port receipts
1 year. Jundiahy re-
9000 last year. To-
red the market un-
sults for 2 days. 4-
revious day.

ce Futures.
Bro. & Co., 214 North

High. Low. Close.
..... 11.40 11.50
..... 11.50 11.55
..... 11.55 11.60
..... 11.60 11.65
..... 11.65 11.70
..... 11.70 11.75
..... 11.75 11.80
..... 11.80 11.85
..... 11.85 11.90
..... 11.90 11.95
..... 11.95 12.00

Market.
Walker & Co., 307
Bid. Asked.
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Stock No. 11.

Tamarack.

SS MACKIN IS HERE

560, Who Danced With King,
Attend Peace Congress.

Spottiswood Mackin (Salie)
who danced with the late

ard VII when he visited St.
the Prince of Wales, is a guest

ter ball was given in his
King Edward VII, spent sev-

er St. Louis.
the Prince of Wales, who

ss Sallie Britton led the
with the Prince of Wales,

er St. Louis society belle is
dent of Paris, France.

plusive is Most Powerful.
April 28.—Prof. Arsene d'Ar-

a new explosive, said to be
more powerful than dynamite

black and liquidified gas. Ex-
in quarries near Paris have

markable results.

True Source
Of Beauty

must be, good health,
skin and face blemishes

usually caused by the
of impurities in the

impurities which also
ecadache, backache, lan-

ervousness and depre-
spirits. If, at times,

here is need you will use

TECHAM'S
PILLS

Tamarack
Stock No. 1

you will improve diges-
keep more restfully and

find yourself better in
way. With purified

the nerves will be quick to
recover the charm of

ng eyes, a spotless com-
rosy lips and vivacious

Good for all the fam-
echam's Pills especially

elp Women
Good Health

the delivery had not been made.
"Ha, ha," laughed Schoenky, "I was

put wise to you fellows. You are po-
licemen and are trying to arrest me

for selling less than five gallons of
liquor at one sale without a retail

the beer, that's all."
liquor license. Well, I won't deliver

"No, that isn't all," returned Phelan,
wasting the receipt. "Either deliver that

beer, or I will arrest you for obtaining
money under false pretense."

The beer was delivered and the liquor
license charge was placed against

Schoenky.
Julius Schira, vice president and man-

ager of the Conrad Grocery Company,
was fined \$100 and costs on a charge

of selling liquor in less than five gal-
lon lots. Judge Miller reduced the fine

to \$50 and costs.
VICE ATTACK "PLOT" FAILS

Attorneys for Girl Witnesses Forced to
Quit Illinois Hearing.

SPRINGFIELD, Ill., April 29.—A
"plot" to attack members of the Illinois

Legislative "White-Slave" Commission
to attack members of the Illinois

to force themselves into the
quit by acting as volunteer counsel for

The "plot" turned out to be a hoax, a
night.

Deputy Sheriff having told one of the
commission's officers that the Sheriff

would be on hand at the session to "run
things."

It was taken seriously, however, as
the police were on hand and were re-

quested by Lieut. Gov. O'Hara to keep
order.

The attempt by Attorneys A. M. Fitz-
Gerald and C. E. Mortimer to address

the commission was productive of much
uproar, laughter and jeering.

They were aided by the sympathy of
the crowd which attended the hearing.

Neither was permitted to make a speech
and they left the hall as O'Hara called

on the sergeant-at-arms to put them in
their seats.

The only witnesses examined were
several girls employed at the local shoe

factory. It was not announced whether
any further hearing will be held in

Springfield.
CRITICISES PIERCE'S MEMORY

Financier at \$1,500,000 Hearing Falls
to Recall Transactions.

The depositions in the suit of the Na-
tional Bank of Commerce against H.

the bank to recover \$1,500,000, the
of the stock in the Nashville Termi-

nal Company, which the bank claims
Pierce has, although it was pledged to

secure loans, will be resumed at 10:30
o'clock to-morrow morning before Spe-

cial Commissioner Hugo Muench.
Mr. Pierce was on the stand yester-

original plan, so she m
of the wedding to yes
the ceremony was not

"Ill-fated" month, they
have the ceremony pe

month of showers.
Mrs. Saxe has been

hair, and is one of the
young matrons in Jew

first husband, Julius,
years ago. She has tw

19 years old and a d
A year ago Mrs. Saxe

Mrs. Bertha Newman,
fellow boulevard, won

"Yippies" ind. While th
May, who is a retir

Charleston, being the
Schwab & May depa

that city.
R. T. CRANE'S W

PARIS, April 29.—A
He United N

kin and Mrs. Richard
Chicago, will be mar

can Church of the Ho
at 4 o'clock to-mor

Invitations have been
friends and relatives

present. Since the en
nounced at the beg

Mrs. Crane and her
living in Egypt. Mr.

Paris and met them a
CHICAGO, Ill., April

society is interested in
Paris to-morrow of

kin and Mrs. Richard
years ago. Mr. Jun

lawyer and was a th
hood. He is a son of

Mr. Junkin of Rocke
Mr. Junkin is a me

New York and Chicag
Mrs. Crane, who wa

son, and Mr. Junkin
before she met the ag

GIRLS DRINK OU
Mistook II

Christmas Duffy, in
her sister, Helen, 8,

rick Duffy, Twenty
streets, Granite City,

as the result of dri
whisky they had m

water.
The girls, who are

Ward, who rooms at
Claude Pool, 2144 Elm

candy and apples, w
them were there. They

At 3 o'clock Mrs. P
children lying on the

of the house, uncon
for Dr. B. H. King.

The physician said
both are in a serio

recovered. In pres

Stock No. 12.

Tamarack.



STEEL EARNS LESS THAN LAST QUARTER

IMPROVED QUALITY IN NATIVE BEEVES

Figures, Though, Are Higher Than Those of Corresponding Period of Last Year.

Best Make Top of \$8.40—Cattle Prices Generally Weak to 10c to 15c Lower.

NEW YORK, April 29.—The financial statement of the United States Steel Corporation for the first quarter of this year, issued to-day, shows total earnings of \$34,426,801 and net income of \$25,696,579.

| RECEIPTS. | |
|------------------|--------|
| Cattle | 2,860 |
| Hors | 11,000 |
| Sheep | 1,500 |
| Horses and mules | 500 |

and \$66,417, respectively, compared with the quarter immediately preceding, but are much in excess of the corresponding quarter of 1917, when total earnings aggregated only \$17,826, 1917, and net \$12,108,415.

SAVING CATTLE—Best Steers—A good supply showed up, but the market was drab, and values lower. Quality was improved, made up a good part of the supply and this variety suffered most. The best price was \$8.50, paid for 3 cars of Colorado pump steers. Good, weights changed hands from \$7.85 to the top, and looked @ the lower. Medium weights of quality sold

The statement was under General estimates, which ran all the way from \$36,000,000 to \$40,000,000. While no official explanation was vouchsafed, it is

[illegible]

lected the corporation's earnings to the extent of at least \$2,000,000. It is considered not improbable that this same cause may find further reflection in the current quarter.

choice ones were not obtainable in quantity. In addition, and more important, the supply was in short order. The best clearing at \$8.50, but one of the best clearing at \$7.75 @ \$7.50. 10 a spread of \$8.75 @ \$8.50. Cows were in fair to some good quality. Bunches and included

dealing with the outlook in the industry, but it was said that orders from the corporation books are sufficient to keep its plants busy for the rest of the year.

The first group was made up of 10 cows, 5 from the first herd and 5 from the second herd. The second group was made up of 10 cows, 5 from the first herd and 5 from the second herd. The third group was made up of 10 cows, 5 from the first herd and 5 from the second herd.

14 per cent on the common, amounting to \$12,628,760, were declared. The board reorganized by re-electing all its retiring officers.

| No. | AV. | Pt. | HEILERS | No. | AV. | Pt. |
|-----|-------|-----|---------|-----|------|------|
| 28. | 18.50 | 66. | 55.5 | 17. | 1.00 | 88.8 |
| 29. | 18.50 | 66. | 55.5 | 18. | 1.00 | 88.8 |
| 30. | 18.50 | 66. | 55.5 | 19. | 1.00 | 88.8 |
| 31. | 18.50 | 66. | 55.5 | 20. | 1.00 | 88.8 |
| 32. | 18.50 | 66. | 55.5 | 21. | 1.00 | 88.8 |
| 33. | 18.50 | 66. | 55.5 | 22. | 1.00 | 88.8 |
| 34. | 18.50 | 66. | 55.5 | 23. | 1.00 | 88.8 |
| 35. | 18.50 | 66. | 55.5 | 24. | 1.00 | 88.8 |
| 36. | 18.50 | 66. | 55.5 | 25. | 1.00 | 88.8 |
| 37. | 18.50 | 66. | 55.5 | 26. | 1.00 | 88.8 |
| 38. | 18.50 | 66. | 55.5 | 27. | 1.00 | 88.8 |
| 39. | 18.50 | 66. | 55.5 | 28. | 1.00 | 88.8 |
| 40. | 18.50 | 66. | 55.5 | 29. | 1.00 | 88.8 |
| 41. | 18.50 | 66. | 55.5 | 30. | 1.00 | 88.8 |
| 42. | 18.50 | 66. | 55.5 | 31. | 1.00 | 88.8 |
| 43. | 18.50 | 66. | 55.5 | 32. | 1.00 | 88.8 |
| 44. | 18.50 | 66. | 55.5 | 33. | 1.00 | 88.8 |
| 45. | 18.50 | 66. | 55.5 | 34. | 1.00 | 88.8 |
| 46. | 18.50 | 66. | 55.5 | 35. | 1.00 | 88.8 |
| 47. | 18.50 | 66. | 55.5 | 36. | 1.00 | 88.8 |
| 48. | 18.50 | 66. | 55.5 | 37. | 1.00 | 88.8 |
| 49. | 18.50 | 66. | 55.5 | 38. | 1.00 | 88.8 |
| 50. | 18.50 | 66. | 55.5 | 39. | 1.00 | 88.8 |
| 51. | 18.50 | 66. | 55.5 | 40. | 1.00 | 88.8 |
| 52. | 18.50 | 66. | 55.5 | 41. | 1.00 | 88.8 |
| 53. | 18.50 | 66. | 55.5 | 42. | 1.00 | 88.8 |
| 54. | 18.50 | 66. | 55.5 | 43. | 1.00 | 88.8 |
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| 56. | 18.50 | 66. | 55.5 | 45. | 1.00 | 88.8 |
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| 58. | 18.50 | 66. | 55.5 | 47. | 1.00 | 88.8 |
| 59. | 18.50 | 66. | 55.5 | 48. | 1.00 | 88.8 |
| 60. | 18.50 | 66. | 55.5 | 49. | 1.00 | 88.8 |
| 61. | 18.50 | 66. | 55.5 | 50. | 1.00 | 88.8 |
| 62. | 18.50 | 66. | 55.5 | 51. | 1.00 | 88.8 |
| 63. | 18.50 | 66. | 55.5 | 52. | 1.00 | 88.8 |
| 64. | 18.50 | 66. | 55.5 | 53. | 1.00 | 88.8 |
| 65. | 18.50 | 66. | 55.5 | 54. | 1.00 | 88.8 |
| 66. | 18.50 | 66. | 55.5 | 55. | 1.00 | 88.8 |
| 67. | 18.50 | 66. | 55.5 | 56. | 1.00 | 88.8 |
| 68. | 18.50 | 66. | 55.5 | 57. | 1.00 | 88.8 |
| 69. | 18.50 | 66. | 55.5 | 58. | 1.00 | 88.8 |
| 70. | 18.50 | 66. | 55.5 | 59. | 1.00 | 88.8 |
| 71. | 18.50 | 66. | 55.5 | 60. | 1.00 | 88.8 |
| 72. | 18.50 | 66. | 55.5 | 61. | 1.00 | 88.8 |
| 73. | 18.50 | 66. | 55.5 | 62. | 1.00 | 88.8 |
| 74. | 18.50 | 66. | 55.5 | 63. | 1.00 | 88.8 |
| 75. | 18.50 | 66. | 55.5 | 64. | 1.00 | 88.8 |
| 76. | 18.50 | 66. | 55.5 | 65. | 1.00 | 88.8 |
| 77. | 18.50 | 66. | 55.5 | 66. | 1.00 | 88.8 |
| 78. | 18.50 | 66. | 55.5 | 67. | 1.00 | 88.8 |
| 79. | 18.50 | 66. | 55.5 | 68. | 1.00 | 88.8 |
| 80. | 18.50 | 66. | 55.5 | 69. | 1.00 | 88.8 |
| 81. | 18.50 | 66. | 55.5 | 70. | 1.00 | 88.8 |
| 82. | 18.50 | 66. | 55.5 | 71. | 1.00 | 88.8 |
| 83. | 18.50 | 66. | 55.5 | 72. | 1.00 | 88.8 |

ing. Quote: Miller—"Trashy, mixed, etc., easy or nominal; offerings next to nothing. Good timothy, but no call for clover. Prices unchanged; some demand for millage and @140—prime German at \$1.45 to \$1.50; to \$1; bright, clean, sound at \$1.25 for tallies to \$3.00 to \$5.00. Timothy 1.60.

[illegible]

at from \$2.10 for weekly to \$3.75 for the best
 good average run; redtop at \$8.00 for 10-
 cleaned seed—interior grades, trawny, etc.,
 less. Sales: 12 sks. monthly at \$8.35; 59 sks.
 at \$7 and 38
 STOOK PEAS—quotable per bu. at from
 \$1.30 to \$1.50
 SORGHUM-CANE SEED—quotable at 90¢

light, very few bunches being sold. Medium weights cleared from \$1.50 to \$1.75. A few odd lots sold above and below these ranges, but they were of little consequence.

SUNFLOWER SEED—Quotable at \$2.15 @ 8.50 per 100 lbs.
DRIED PEACHES—Little or none offering; prices nominal; sun-dried quarters apples at \$2.75; evaporated thin apples at from 3c to 4c; ordinary to 5c; cores and peeling peaches at 5c to 5.5c.

Stockers and Feeders — The market was very dull, due to limited supply. A good quota embraced killing kinds. Two bunches of fair steers for feeder purposes at \$7 was about the only transaction worthy of note. Comparatively few cows and heifers went to stock buyers. A fair supply of milkers

Stock No. 13.

Noble Fir.





a rush to the
restaurant
this no

Stock No. 13

as for to-night
is that we hope the
ordered about two t
amount from the bu

Noble Fair.

After reading some
stories in the

PURE FOOD NUMBER

of

The New York Evening SATURDAY MAGAZINE

your appetite will be something fearful. We warn you not to read it if you can't afford a square

The Perpetual Potato

an attack on that time-honored starch bomb, by Henry T. Finck, author of "Food and Flavor." He commends spaghetti.

Canned Interview with a Chef.

Foster Ware, is accompanied by other confessions telling why the kitchen lords of big hotels are proud of their baked beans.

Dining Out in New York

made of some piquant ingredients left (in the form of notes) by Samuel Ward, a 19th century gourmet, for whom they still name dishes. Incidentally it traces the history of Delmonico's.

Another Little Crucified Sisters Romance

by L. J. Beeston.

Brooklyn Bridge Maligned

Simcon Strunsky, the Post-Impressionist, experiment to explain the plausibility of

Four Famously Lovely

are the flavor of this week's portion of stage reminiscences. To wit: Adeline Rehan, Kate Claxton, and Sara Jewell do their youth and charm full justice.

A Page of Fashions

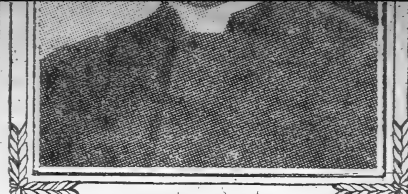
sent direct from Paris by our own Florence H. Barkley.

Art—The Stage—Science—Fair Play's Sports—More

There are 60 pictures in this number, a piece of superb color work, the "Lilian," by Robert Henri.

This magazine accompanies the New York Evening Post on Saturdays, and the paper and magazine is only 5 cents a copy at all newsstands. (\$2.50 a year by mail)

all the payments on the
ts for construction.
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at \$150,000, still re-
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lives that all this is
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quite so certain this
is possible, and he
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REV. MAXWELL GANTER

should be given be-
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the great tower; for
work and furnishings
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furnishings, on the
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a question often
Ralph Adams Cram
r Goodhue who de-
stating that there is
he says:—
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son to believe that
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January 1 Mr. Cram
ered into a separate
es in Boston, while
es independently in

Ritchie, who becomes rector emeritus. Mr. Ganter is a son of the late Rev. Dr. R. S. Ganter, who was rector for many years of St. Paul's Episcopal Church, Akron, Ohio, where the son was born, May 31, 1883. Mr. Ganter was graduated at Kenyon College in 1904, and from Yale Graduate School in 1906. He spent the next year abroad. On returning he entered the General Theological Seminary, this city, and was graduated in 1910. He was ordained the same year in St. Thomas' Church by Bishop Sidney C. Partridge. Mr. Ganter has served as curate at St. Martin's Church, New Bedford, Mass.; Cathedral, this city; Christ Church, New Haven; St. Mark's Church, Philadelphia, and Grace Church, Newark, N. J.

Drew Methodist Theological Seminary, Madison, N. J., has established the Chair of Missions and Comparative Religions and has elected to it the Rev. Dr. Edmund Davidson Soper, professor of missions in Ohio Wesleyan University. He is the son of Dr. Julius Soper, a veteran missionary, and was born in Tokio thirty-seven years ago. The young man is a graduate of Dickinson College and of Drew Seminary. He has served as college secretary of the Pennsylvania Y. M. C. A. and as secretary of the Missionary Educational Movement.

The Rev. Frank H. Simmonds has accepted a call to Grace Episcopal Church, White Plains, N. Y., as curate to the Rev. Dr. Frederick Van Kleeck.

"GO TO CHURCH SUNDAY" HERE

West Side Churches Unite for Move-
ment and Fix Washington's
Birthday for the Date.

"Go to church Sunday" has been fixed for Washington's Birthday by forty Protestant churches of the Manhattan west side below Forty-second street, by all on Staten Island and by those of the Far Rockaway part of Long Island. In the Bronx the preceding Saturday has been included. The west side Manhattan churches adopted a resolution urging the fixing of some future date for the whole city, but voted themselves to observe February 22.

West side churches taking parts include the University Place, First, West Twenty-third Street, Greenwich and Faith Presbyterian; Metropolitan Temple and Washington Square Methodist, Ascension, Holy Communion, Holy Apostles and St. John's Episcopal; Sixteenth Baptist and Knox Memorial Reformed.

Announcement was made of the result of a canvass made in behalf of a "go-to-church Sunday" for the entire city. Dr. S. Edward Young, pastor of the Bedford Presbyterian Church, of Brooklyn, said that the vote in favor of such a Sunday had been practically unanimous and that the third Sunday in October had been the date selected.

writes:—"It was a great help. I
our non-Christian children do not
clothing until they are six or eight
old. We, however, require our C
children to wear clothing for the
services; hence your box was a
to many parents unable to buy clot
their little ones. We overlooked i
the babies, as the material wasn't
cient, and they appeared cloth
smiles."

Miss Mabel eParson Schmidt, w
the last year has been a member
deaconess staff of St. George's E
Church, has resigned to become a
of English in one of the public
She will continue as a volunteer w
the Sunday school.

Mrs. M. B. Norris, of the W
Board of Foreign Missions of the R
Church, who has recently returne
Japan, will address the Woman's
of the Marble Collegiate Reformed
Monday morning in the chapel, Fif
ue and Twenty-ninth street.

The Society for Women's Work
Broadway Tabernacle, at Fifth
street, will hear a lecture Tuesday
Lovell Murray, and February 24
Mills, of Schaeffler Institute.

The eleventh annual meeting
Young Women's Hebrew Associati
be held at the headquarters to-
afternoon at three o'clock. The s
will be Mrs. Charles H. Israels a
Rev. Dr. David de Sola Pool. G. I
Davis, chairman of the Building C
tee, will report on the association's
during the year.

A retreat for the Associates of t
ters of the Holy Nativity and other
will be held Wednesday in the Ep
Church of St. Mary the Virgin,
sixth street, east of Broadway. The
will be the Rev. Dr. Joseph G. H.
the rector.

MORIAL GEORGE'S

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and Solicit

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George's Episcopal
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nd, the rector, said
connection a stone
dered. At present
pulpit in the centre
situation is unique
ch. Because of the
an experiment of
of the pulpit and
ried. Mr. Reiland
Mr. Morgan in has
sided.

Socialism Chan

Attorneys for Operators D

That Party Was Responsi
for Strike.

[SPECIAL DESPATCH TO THE HERA
HANCOCK, Mich., Friday.—The C
sional investigation of conditions
up to the copper strike in Michigan
iscs to develop some stormy pa
among the members of the Congre
committee as well as between at
representing corporations and the V
Federation of Miners.

This was indicated this afternoon
there was a discussion of socialism
the committee. Attorneys for the
companies questioned witnesses f
miners to prove the contention th
strike was born in socialism; th
federation is backed by the socialist
and that the present industrial dis

Stock No.14.

Alpine Fir.

HOUSEWORK.—General housework, ready to place at once experienced, reliable and trusted colored woman, five years old and 347 Riverside Drive apartment 4A, Tel Aviv 3753.—Middletown.
 HOUSEWORK.—Would like position as maid or general worker for one perfectly competent; reference furnished. W. L., 216 H. Harlem.
 HOUSEWORKER, English, thorough good cook, highly recommended, trustworthy. T. 415 West 34th.
 HOUSEWORK.—Irish girl for housework, plain cooking; apartment, Holland, 246 94th st.
 HOUSEWORK.—German, middle aged woman best reference. Otero de Pass, 61 West 74.

Stock No. 1
Alpine Fi
WATCH FOR IT TO-MORROW.
 meet all requirements.
 will find stock offered to
 wanting a dog of any breed
 Kennel Directory. Any one
 New York Herald Sunday
 country advertise in the
 ers and exhibitors in the
 The most prominent breed-
To Dog Buyers

SPECIAL NOTICES.
 Must be set solid in agate.
 Medical—50c. agate line Daily and Sunday
 WEST 63TH ST.
 WHEN NECESSARY. DR. GORMLEY, 123

suitable married couple
 in Walter Deal: the
 s, double clo. e, run-
 ing parlor and base-
 ment.
 business ladies, with
 excellent large Room,
 double, single steam
 running water, tele-
 phone, bath, BIRD.
 n, modern apartment,
 me, Apt. 2 East.
 in owning modern
 Room, twin beds.
 Room; suitable for
 orbed; central; tel-
 ous; shower baths.
 sunny front Rooms
 breakfast optional;
 om, bath adjoining;
 Room, private bath.
 all Room, near sub-
 child small Room;
 s; reasonable; refer-
 ces, quiet surround-
 furnished, sunny
 ate bath; reference;
 St. - Furnished
 Rooms, sin-
 ORTLENDY.
 with two gentlemen;
 Room, MILLER.
 Kensington and Park
 giant large Parlor;
 stant location; Hun-
 to adjoining Rooms;
 optional, Egan.
 gentlemen to share
 conveniences; refer-
 men preferred; tel-
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 back Parlor; hot,
 three sunny front
 a light up; private
 DWAY, SHELLEY.
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 tel; telephone; ref-
 a handsome private
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 an ideal home;
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 and
 (97th).—Southern
 view; elevator;
 block, 1289—River.
 URNUITY.
 SILVER, 850 Herald.
 nite, time Daily
 weekly scale

[SPECIAL DESPATCH TO THE HERALD.]

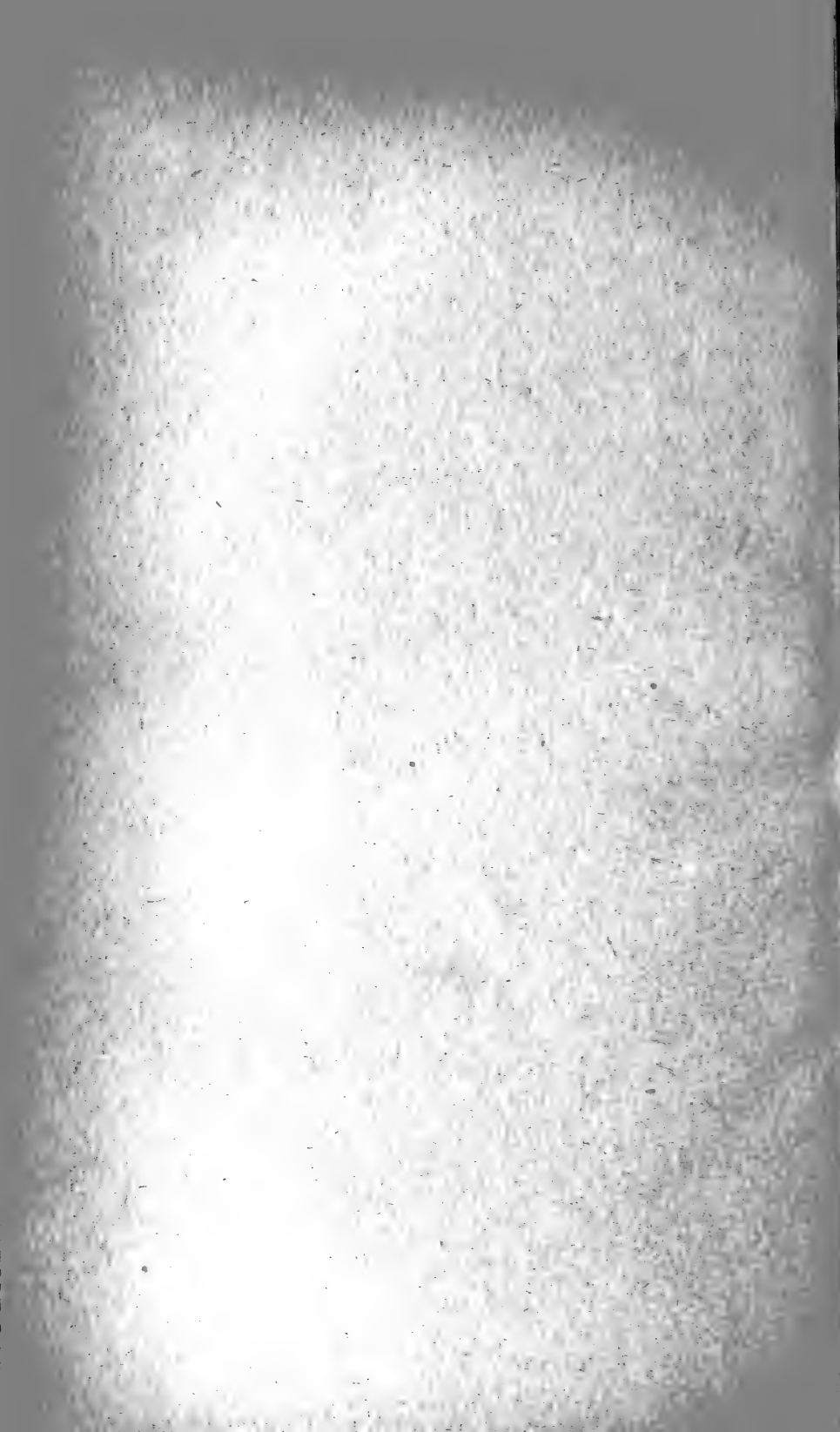
WHITE PLAINS, N. Y., Friday.—Justice Mills to-day granted an interlocutory decree of divorce to Luigi Masnada, of No. 17 Prospect street, New Rochelle, and against Sara Lathrop Herreshoff Masnada, a daughter of Mr. and Mrs. J. B. Francis Herreshoff and a niece of Captain "Nat" Herreshoff, yacht builder. Mrs. Masnada lives at No. 54 West Ninety-second street, New York.

Giovanni B. Moezel, a silk importer, who

[SPECIAL DESPATCH TO THE HERALD.]
HARTFORD, Conn., Friday.—Throughout
the afternoon a wonderful sun dog, of un-
usual size and remarkable beauty, was
visible. The strange phenomenon had a
regular effect on the superstitious, who
were expecting something dreadful to hap-
pen on Friday, the 13th.
William J. O'Farrell, of No. 331 Front
street, who has been acting strangely

Stock No. 15.

White Fir.



HORNTON MAGER OF RAILWAY

tendent of the
Railroad
London.

ERN HAS
EXECUTIVE

ernization of Sys-
olicies of Trans-
ines Here.

THE HERALD VIA COM-
MPANY'S SYSTEM.]
HERALD BUREAU,
No. 130 FLEET STREET,
London, Saturday.

of Mr. Henry W.
uperintendent of the
ad, as general man-
Eastern Railway has
is considered in the
ictory for American

that I can tell the
it why I was selected,"
last night, "unless it
pened to suit. I am
BALD, as usual, has a
en anything happens.
it to fail, which ex-
y the HERALD has
oreign service in the

o-morrow aboard the
h up my affairs in
eturn in April.

urity between the Long
eat Eastern railways,
e same class of travel,
selecting the methods

ble on the Long Island
n to British railway
in some instances be
ained. But please em-

at there are to be no
al changes; no general
erican cars for British,
away with the British
which I consider ad-

Nine Americans at Court with Mr. and Mrs. Page

First Presentation of the Season Is Held at Buckingham Palace and Is a Very Brilliant Event—Queen Mary Ablaze with Gems, Including the Star of Africa.

Stock No. 15

THE NEW SHOWER EMBROIDERIES ARE S

[SPECIAL DESPATCH TO THE HERALD VIA COM-
MERCIAL CABLE COMPANY'S SYSTEM.]

HERALD BUREAU,
No. 130 FLEET STREET,
London, Saturday.

The first court of the season was held by the King and Queen at Buckingham Palace last night. It was a brilliant affair, many strikingly beautiful costumes being worn, while the dazzling display of jewels made the scene one of exceptional brilliancy and splendor. The dresses and trains were enriched with the latest shower embroideries, which had a lovely effect. More than eight hundred persons were present.

King George wore the uniform of the colonel in chief of the First Life Guards. The Queen's dress was of blue and silver brocade, with a train of Honiton lace, and lined with silver tissue and trimmed with sprays of silver roses. She wore the crown pearls and diamonds and the famous Star of Africa diamond blazed on her corsage. Her other ornaments were rows and ropes of pearls and the Order of the Garter.

Mr. Walter Hines Page, the American Ambassador, presented his son, Mr. Arthur Page, and Mr. Edward Bell, Second Secretary of the Embassy, while Mrs. Page presented her daughter, Miss Page; her daughter-in-law, Mrs. Arthur Page; Mrs. Bell, mother of Mr. Edward Bell; Miss Kate Fowler, of San Francisco; Miss Sylvia Fox, of Philadelphia; Miss Harriet McCook, of New York, and Miss Elizabeth Wells, of Boston.

JUDGE CRITICISES THE WAR OFFICE SYSTEM

Says England Puts at Its Head Per-
sons Who Have Never Worn
Any Uniform.

[SPECIAL DESPATCH TO THE HERALD VIA COM-
MERCIAL CABLE COMPANY'S SYSTEM.]

HERALD BUREAU,
No. 130 FLEET STREET,
London, Saturday.

At the resumed hearing of the army
libel action yesterday Justice Darling ex-

White Fir

which was a successful exhibi-
Basset hounds, this afternoon, wh
the champions were, paraded before
She also saw the dogs that receive
tinction for various acts of heroism

MR. BELL'S WEDDING TO BE A QUIET

Second Secretary of American
bassy in London Will Marry
Surtees Next Week.

[SPECIAL DESPATCH TO THE HERALD V
MERCIAL CABLE COMPANY'S SYST
HERALD BUREAU
No. 130 FLEET ST
London, Saturd

In consequence of a recent berea
and serious illness in the bride's
the marriage between Mr. Edwa
Second Secretary of the Americ
bassy, and Miss Etelka Surtees v
place quietly next week in London
the Ambassador and Mrs. Page, o
of the embassy and a few near
have been invited.

MRS. LOTT DIES IN LONDON, AGE

Widow of Charles F. Lott,
Francisco, Succumbs Af
Long Life.

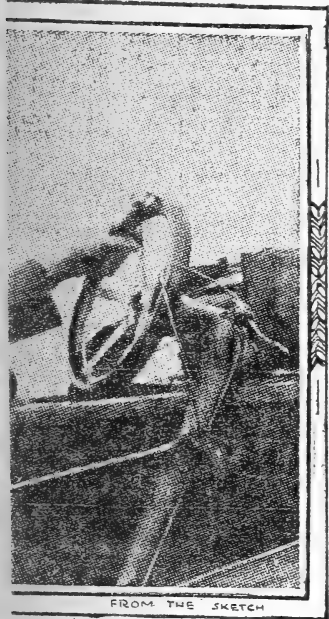
[SPECIAL DESPATCH TO THE HERALD
MERCIAL CABLE COMPANY'S SYS
HERALD BUREAU
No. 130 FLEET S
London, Satur

The death took place on Thursd
37 Matheson road, West Kensit
Mrs. Jessie S. Lott, widow of C
Lott, of San Francisco, in the
ninth year of her life.

PERU'S VICE PRESID IS LEAVING FOR I

[SPECIAL DESPATCH TO THE HERALD
MERCIAL CABLE COMPANY'S SY
HERALD BUREAU

lane May n the Water



FROM THE SKETCH
E.R.N.

Planes That Can Be Un- ing Craft To Be pat.

the control is perfectly instinc- wheel being pushed forward and control the elevation of the ma- and turned from side to side to t laterally. In turning the wheel e to side the rudder handle is ith the wheel, thus giving a per- al balance, and in turns it is only to off-set the rudder handle to or the other, still controlling the sition of the machine by turning and handle together sideways. e of control was adopted after dy had been made of all existing nd combines many features that me standard in Europe, the r lateral balance by the steering r example, being the standard nt in the German army and he German Wright aeroplanes. l feature of the control is the nner in which the rudder control ed with the warping. een known for some time that ht Company contemplated a control, and aviators have been rested to know what form this e. Expert flyers, among them Atwood, Oscar Brindley, Beck- ns and several of the army and en, have expressed admiration w system, particularly because nctiveness, which is bound to uch easier and safer to fly than

PLAY SEMI-FINAL ON TUXEDO COURTS

C. G. Osborne, of Chicago, and C. C. Pell Win Right to Meet for Gold Racquet Championship.

[SPECIAL DESPATCH TO THE HERALD.]
TUXEDO PARK, N. Y., Friday.—The semi-finals for the gold racquet championship were played on the courts of the Tuxedo Tennis and Racquet Club to-day. C. G. Osborne, of the University Club, of Chicago, defeated G. Maurice Heckscher, of the New York Tennis and Racquet Club, three games to two, and Clarence C. Pell, of the Tuxedo Tennis and Racquet Club, won from Arnold F. McCormick, of the University Club, of Chicago, three games to one. Messrs. Pell and Osborne will meet to-morrow in the final.
Mr. Osborne took the first game easily from Mr. Heckscher by 15-8, but the second was close all the way. The score was tied at thirteen all, Mr. Osborne finally winning by 18-15. The third game was also close, twelve all being called before Mr. Heckscher obtained a lead that brought him victory by 15-12.
The fourth game was all Mr. Osborne's, but the fifth and deciding one was a hard contest. Mr. Osborne in his first five hands scored fifteen aces to Mr. Heckscher's five. Mr. Heckscher, in his two hands that followed, added five more, bringing his score to 10-13. The West-érner, however, easily acquired by his effective service the two necessary aces for a 15-10 triumph.
Clever playing was witnessed in the match between Messrs. Pell and McCormick. Mr. Pell, the younger man, finally won through superior staying powers and effective returns of the long rallies.
The summary:—
Osborne vs. Heckscher.
FIRST GAME.
Osborne 6 8 1-15
Heckscher 4 1 1-6
SECOND GAME.
Osborne 0 7 0 0 0 5 0 1 0 8-18
Heckscher..... 0 2 0 2 1 1 3 0 1 1 2 2-13
THIRD GAME.
Osborne 2 0 0 5 0 2 3 0-12
Heckscher 0 6 1 0 2 4 1 1-15
FOURTH GAME.
Osborne 1 2 0 1 0 0 0 1 0-5
Heckscher 1 3 1 0 0 1 6 2 1-15
FIFTH GAME.
Osborne 1 3 1 0 8 0 0 2-15
Heckscher 0 0 0 1 4 4 1 0-10
Aces by services—Osborne, 37; Heckscher, 35.
Aces by placing—Osborne, 20; Heckscher, 22. Aces

NO NEW TENNIS

National Organ- Discussion, M Policy at A

Arguments over definition of an ar took up most of the meeting of the Un Lawn Tennis Associ Waldorf-Astoria Ho ing of that body. T opposition develop offered by the orga Merrihew had drafe
A vote of those pr was taken and the amendment was pass it one of the laws was necessary to hav
When it came to gramme there was cussion and delay th night before the res It seemed hardly pos be a chance of any of the American body. pat policy on the re- trol the sport in thi
The change in the amateur definition fa being 87 in favor and
The amendment as hew was the following
Has not accepted m game in a tourname- tion, but a player, club or association tournament, match or it and sanctioned by National Lawn Tenn accept actual railroad his home to the city w is held, and such hos may provide, but sh money in lieu of hospi
A player when of represent an associa world's championship petition or in a tourna- auspices of the U. S. representative team c- ceive from such asso- necessary travelling a- ing expenses. Such must report the tota such player on reques Committee of the U. S. or association must of the holding of a to the secretary of the U. amounts paid by them. portation and expense participated in such to- names of such players.
Robert D. Wren
Outside of the choice dent and the secretary cers was cut and dried. was again elected to t Henry W. Slocum, the

Stock No. 16.

Engelmann Spruce --- Colorado.

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Stock No. 17.

Amabilis Fir.

belts and patch pockets, nearly all with the patch pockets.
all styles.
\$6.50 to \$10 Suits & Overcoats, \$4.50
a wonderful opportunity for those who desire a
range of boys' clothing; sizes 2½ to 18. Many a prize

2 to \$3 1914 Boys' 75c Separate
Suits, \$1.10 Trousers, 35c
styles, for boys 2½
Gray and blue mixtures;
sizes 6 to 17.

Men's \$12 and \$15 Suits **Amabilis Fir**
Overcoats, \$6.50

one all wool, good standard quality; styles and
for young men; sizes 32 to 42.

leading makers in Amer
in medium and heavy
fitting models, some w
as \$14.50.

Men's \$18 to

Many Overcoats fu
fabrics. The Suits in 1
mixture; all sizes, 33
garments.

Men's \$15
Chauffeur
Men's \$10 and
Men's \$4.5
Men's \$8.5
Men's \$15 M
Men's \$3

BLUM BROTHERS' SPECIALIZ

Men's Suits

Suits and Blouses

Men's and Children's Suits

Suits and Fur Coats

Women's G

Women's C

And there will be wonderful Bargains in
following Sections TODAY

Men's Suits
Men's Costumes
Men's Separate Skirts
Men's Wraps
Men's and Waists

Underwear
Men's Shoes
Men's Shoes

Jewelry
Silverware
Silverware
Articles

Carpets and Linoleums
White Goods
Children's Dresses
Children's Wraps
Buttons and Braids
Art Needlework
Women's Neckwear
Leather Goods
Traveling Bags
Ribbons
Laces
Handkerchiefs
Embroideries
Infants' Outfits

Colored Petticoats
House Dresses, Ne
Corsets
Trimmed Millinery
Kid Gloves, Fabric
Colored Dress Goo
Flannels

Men's an

Furnishings Raincoat
Gloves Leather
Hosiery Shoes—
Boys' Ha

small measure the serious of George Borrow. Mr. B., with an amount of detail it seem superfluous in the case of less individuality, with Born, birth and upbringing during times when Napoleon's menacing menace to England, and is many journeys to far off which he obtained material. He gives us, moreover, a portrait of his day and of the and women of literary taste ment whose influence remained throughout his life. He tells us of his extraordinary facility in the of foreign tongues, of his in of prize fighting—his own at "Big Ben," a famous pugilist, in Hyde Park—and of his ess for the wandering gypsy read of his Journey to St. in the interest of the Bible So various trips to Spain, and id helps us to a better under- his work. There are still many try who read "Lavengro" and in Spain," and to these Mr. lume will prove of value and it can awaken a new interest e subject, the author will have till greater service to our gen-

"Joan's Green Year" (Mac- love story, charmingly writ- of gentle feminine sentiment ve a strong appeal for those recite a quiet story of Eng- e. It takes the form of a se- rs written by Joan Cantley ided house to her brother in ts pages are rich in descrip- tic life and a sympathetic the little comedies and trag- eake up neighborhood interest- of these events presents as a woman of good social ondon who has written books to marry a lord, not because ke in the offing, but because love him. This may seem any of those who have been modern British fiction, but a event awaits those who fol- areer to the end. For the English fiction, so far as my s, an attractive heroine is er publisher. In real life, of hers woo and win and are ooded almost every day in the pen with manuscripts to dis- in this novel we see a pub- a much sought after bride For my own part, I am glad e done to a well deserving ithout publishers there would i for manuscripts, and even always eager to accept them. n rambling from my subject. is made up of a number of She describes the family at tm, which receives her as a is the English politely term quest." She tells the pathetic Ingleby, whose farm, held by forebears for two centuries, him and is cut up into small- and she relates also the still episode by which he loses the loves. Another tragedy is ret Derston, the victim of a and, and there are brighter tell of troubles cheerfully e affairs with a satisfactory he whole, the book has a nosphere that cannot fail to

death of this brother, some forty years later, she had a square of glass let into the floor of the family pew which was directly over the family vault. In her brother's coffin she had glass placed directly over the face and, the coffin being put in place, she gazed once, but once only, upon the man who had ruined her life. Then there were less tragic figures, such as Mrs. Thorn, once a handsome fish girl, whose marriage proved exceedingly happy in spite of much opposition, and Mrs. Blackford, wife of the doctor, who considered herself scientific by marriage and had learned to know what she was supposed to see down her husband's microscope. The book is delightfully written with a distinction and simplicity of style as charming as it is unusual.

When Bret Harte opened for us the door into that magical though unreal world of California in the days of the gold seekers he also cleared the way for a host of imitators. It is impossible to read "The Twins of Suffering Creek," by Ridgwell Cullum (Jacobs), without realizing that the author is an admirer of "The Luck of Roaring Camp" and "The Outcasts of Poker Flat." It is the story of a Western mining camp, of an inadequate, amiable man whose handsome wife runs away with the good looking desperado of the vicinity, leaving her twin children to the care of their hopelessly incompetent father. The situation appeals to the compassion of the camp, and a syndicate is formed for the care of the children under the leadership of one "Wild Bill," a gambler, horse lover and general master spirit of the camp. Of course this syndicate is entirely unable to cope with the situation, and its attempts afford an opportunity for what the author evidently considers humor, but which seemed to me but a dreary succession of foolish incidents. The forsaken husband is so anxious to have his wife back, so loyal to the mother of his children, that the heart of "Wild Bill" is touched and he goes forth to kill the man who has added to his other crimes that of stealing a man's wife. The gambler succeeds, losing his own life in the act, and the repentant Jessie returns to her husband, who has found an oil well on his claim instead of the gold for which he was looking, and whose twins are further provided for by inheriting "Wild Bill's" bank account, some seventy thousand dollars. The book is poor in character drawing, dull in incident and extremely tiresome to read.

Tolstoy's Short Stories, published at a cheap price as No. 129 of the Scott Library, are very much like the stories of Russian peasant life that so many authors have given us. I have never been strong for

NEW PUBLICATIONS.

"Goddess of the Dawn"

By MARGARET DAVIES SULLIVAN

"The Goddess of the Dawn," in the opinion of one of the editors of the time, "is the season's most delightful sentimental novel."

Doris, its heroine, will remain for many a day the best example of pure young womanhood in fiction.

"Fragrant and clean as the rose garden in which it opens is of the Dawn."—*New York Times*.

strongly the latter British Parliament. considers that political means in Germany which land he is much mistaken its original theory of a numerical basis, there have about six hundred instead of 397, and the towns should be. What the author has the elaborate police system is interesting, though a dash at the idea of the population being of the intricate system of vision Mr. Tower thinks doubtful preventive of tends that it is of little ing of criminals. The chapter on municipal housing conditions in stance, are far from the streets are beaut the apartment houses boxes seem very attractive rents are high, and wish something less obliged to go into of rooms at the rear, looking yard which twice a week beating of innumerable are other chapters, dealing topics as education and intellectual life, and interesting as well as instr

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Also, GERMAN and FRENCH

This sale, as usual, a splendid opportunity Buyers to acquire notable reductions in

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BRENTA

5th Ave. and 27th St.,

White Spruce.

Grinder Run No. 190.



Western Hemlock.

Grinder Run No. 9.



Sitka Spruce.

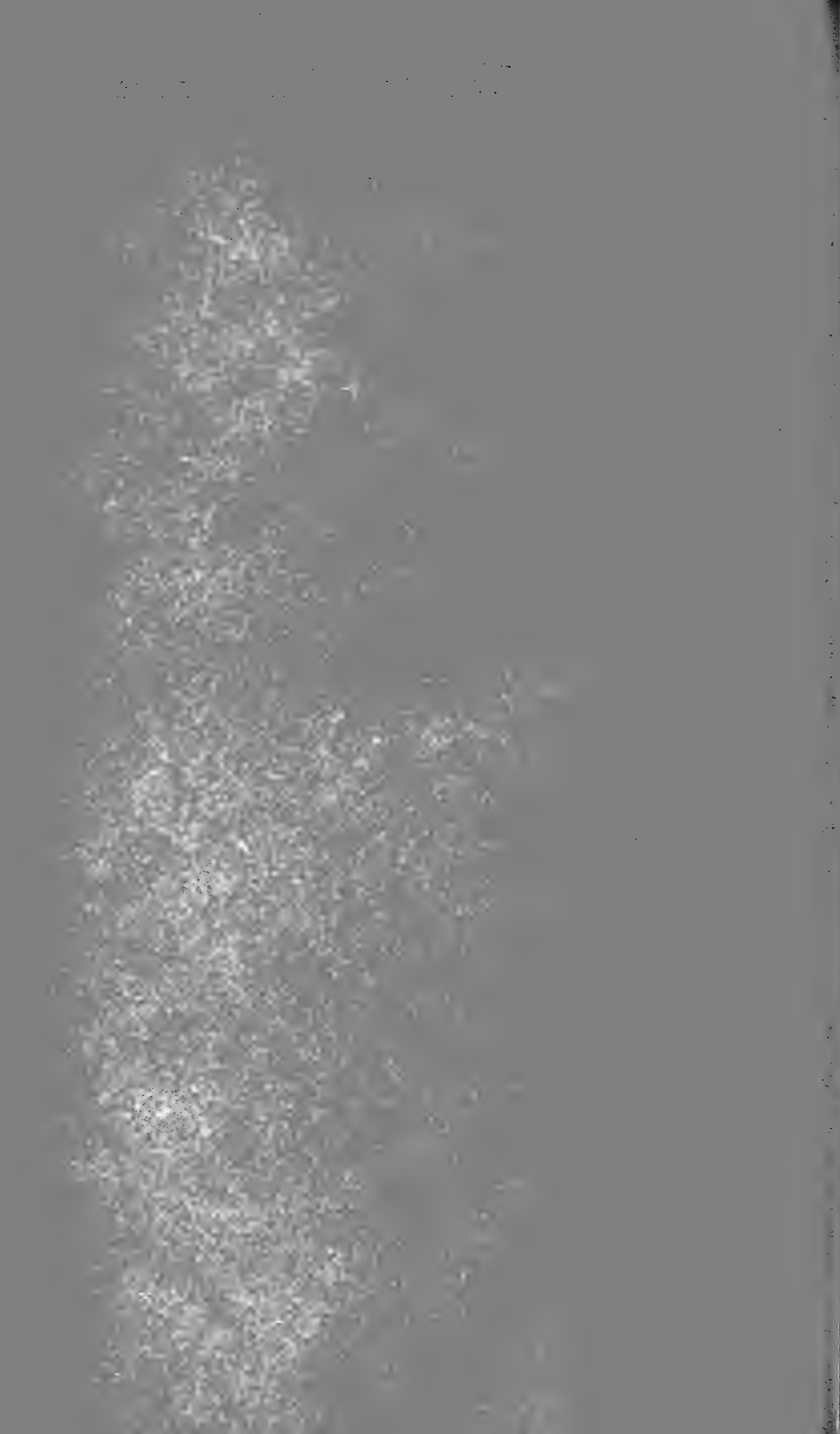
Grinder Run No. 6.

Lodgepole Pine. --- Montana..

Grinder Run No. 14.

Western Yellow Pine.

Grinder Run No. 8.

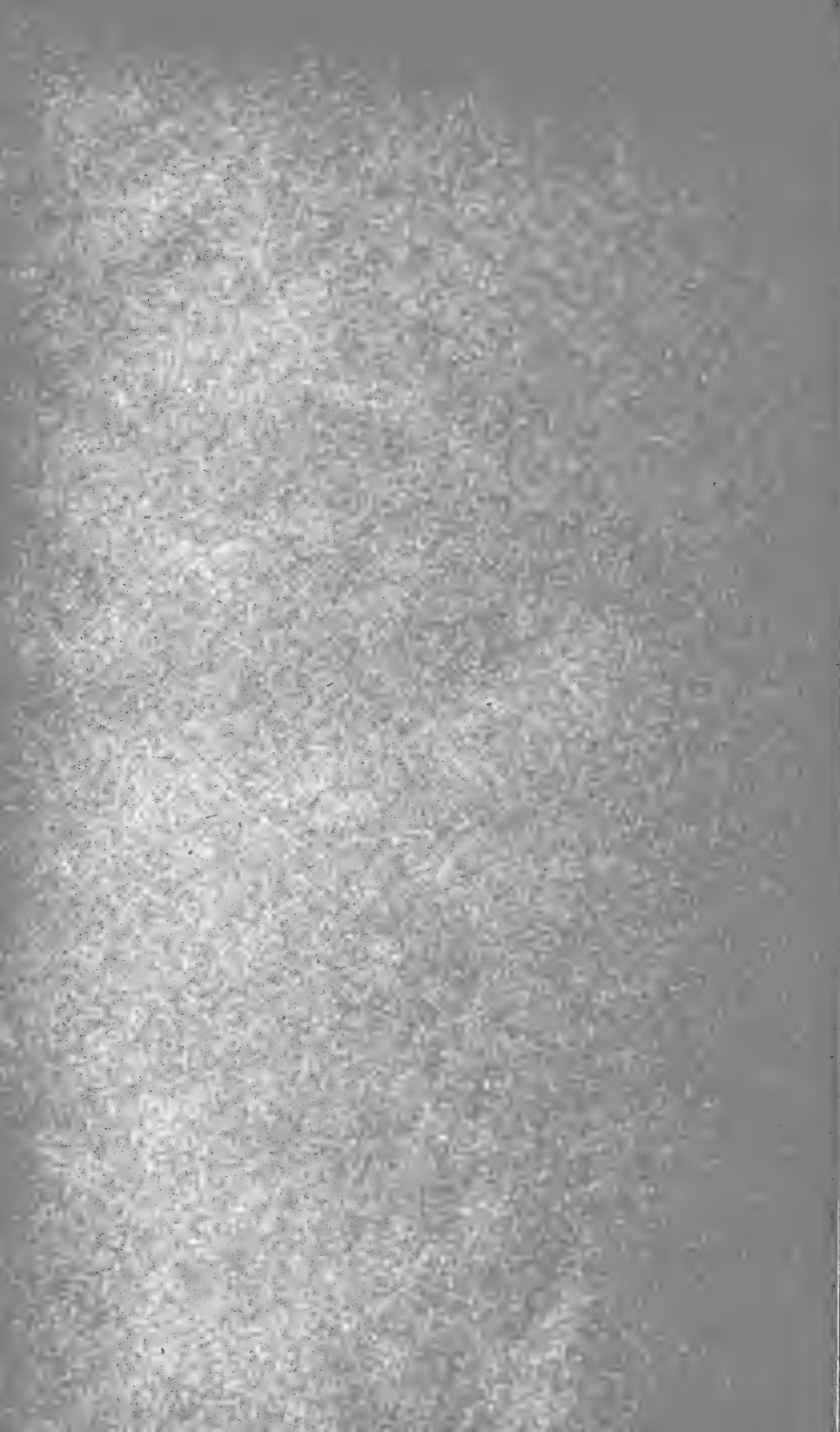


Balsam Fir.

Grinder Run No. 27.

Lodgepole Pine --- California.

Grinder Run No. 1.



Red Fir

Grinder Run No. 2.

Hemlock.

Grinder Run No. 61.

Tamarack.

Grinder Run No. 27.

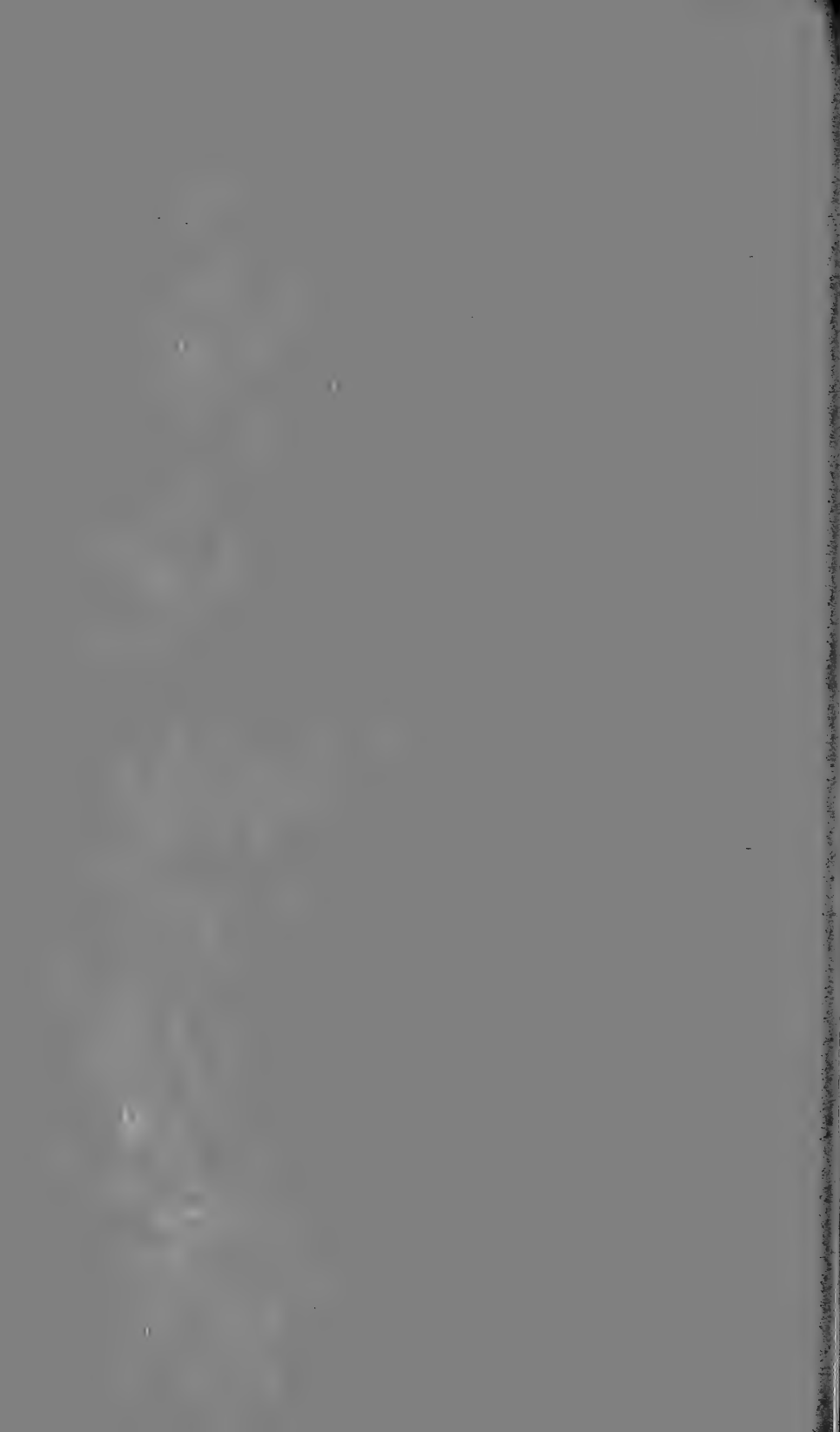
Noble Fir.

Grinder Run No. 11.



Alpine Fir.

Grinder Run No. 12.



White Fir.

Grinder Run No. 24.

1872-1873

1872-1873

Engelmann Spruce --- Colorado.

Grinder Run No. 14.



Amabilis Fir.

Grinder Run No. 10.

Jack Pine.

Grinder Run No. 30.

White Pine.

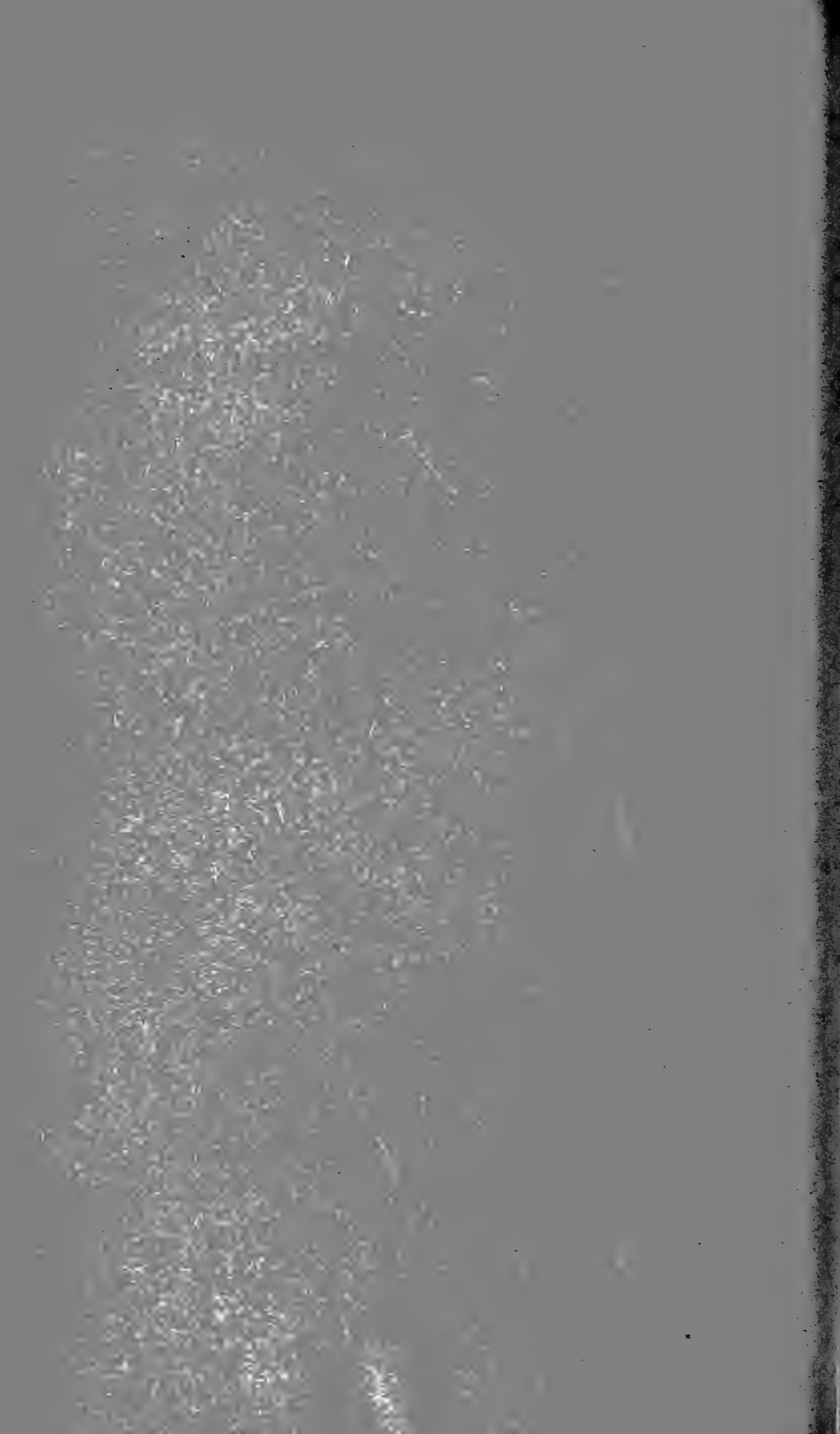
Grinder Run No. 11.

Aspen.

Grinder Run No. 3.

Birch.

Grinder Run No. 5.



Black Gum.

Grinder Run No. 10.

Loblolly Pine --- fall cut.

Grinder Run No. 19.



Loblolly Pine --- Spring Cut.

Grinder Run No. 18.

Lowland Fir.

Grinder Run No. 2.

Engelmann Spruce --- Montana.

Grinder Run No. 10.

Western Larch.

Grinder Run No. 1.

